VOL. XVI.
No. CCCXCVI.] JUNE 27, 1885. [PRICE, INCLUDING INDEX, FOURPENCE.

JUL 6 1885

# THE ELECTRICAL REVIEW

LONDON: PUBLISHING OFFICE, 22, PATERNOSTER ROW, E.C.—SUBSCRIPTION per annum, Postage inclusive, in Great Britain, 19s. 6d.; to Countries in Postal Union, of the first class, 21s. 8d.; of the second class (Aden, India, Persia, &c.), 22s. 10d.—NEW YORK: D. VAN NOSTRAND, 23, Murray Street, and 27, Warren Street. PARIS: Madame VEUVE J. BOYVEAU, Librairie Etrangère, 22, Rue de la Banque. BERLIN: A. ASHER & Co., 5, Unter den Linden.

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THE TELEGRAPHIC JOURNAL AND
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VOL. XVI.—NO. 396.

## CABLES FOR MILITARY PURPOSES.

A CURIOUS coincidence, which, in the case of a war such as recently threatened us, may be easily reproduced in a much more effective manner, now furnishes us with a warning which should not be overlooked. We refer to the interruption of traffic in the Suez Canal on the one, and to the simultaneous breakdown of both the submarine cables to India on the other, hand. The consequences of the interruption of these cables do not, however, make themselves much felt at present, as messages can still be transmitted to and from India and the East by means of land lines. These latter, however, would have to be left out of account should we be concerned in a war where speedy communication with our Eastern possessions might be of vital importance. The recent blocking of the Canal, although accidental, shows how easily that road to India may be rendered unserviceable. A much more serious delay could be produced were any large vessel, appropriately loaded, to be sunk in that part of the Canal where the channel had to be cut through rock.

We have already had occasion to point out the imprudence of relying solely on the existing cables for the maintenance of communication with India and the East generally, as apart from the fact that they would be simultaneously affected by possible political complications in Egypt, we now find that they are also liable to simultaneous interruptions, due to other causes. Thus it requires no exercise of imagination to realise that, at the time of greatest need, telegraphic intercourse with all our Eastern possessions might be stopped; and that traffic through the Canal might be so interfered with as to oblige all transport, shipping, &c., to resume its old route round the Cape. When war with Russia seemed imminent, and before the occurrence of the awkward *Bosphore Egyptien* episode in Egypt, we suggested that to secure an alternative route to the East for military purposes, a cable might be laid from India, *viâ* Mauritius, to the Cape of Good Hope, there joining the cables which the Government propose laying along the West Coast of Africa.

The route to India *viâ* Mauritius has been loosely criticised; the arguments brought against it, however, being such as only serve to prove that it is admirably adapted to the purpose for which it was suggested. It has been objected that the water is deep, and that the weather is such as to render repairs difficult. Cables have, however, been laid in water quite as deep; and the selection of a type of cable suitable to the depth, does not appear to us to be a matter of great difficulty; the cable could then be left to such protection from hostile attempts as depth of water and convenient cyclones would afford it. Another point brought against this route is, that it has not been sufficiently explored; it would be just as reasonable to bring forward against the laying of any cable the fact that it has not been already laid. We fully recognise the fact that preliminary exploration is necessary; indeed, were such a lesson required, unfortunate experiences in these very waters teach us the results of laying cables over ground which has been insufficiently surveyed. Proposals for a cable from Natal to India *viâ* Mauritius and Diego Garcia were submitted to the Government some time ago by Messrs. Siemens Brothers; the Telegraph Construction and Maintenance Company also tendered for a cable to Mauritius, pointing out, however, at the same time the difficulty of accomplishing repairs. These proposals go to show that the laying of such a cable is practicable, and the supposed difficulty in effecting repairs, argues a corresponding difficulty in damaging the cable. There is no doubt that the Government would have to pay heavily for such a work, but we venture to believe that should a war arise, such as that which recently threatened us, the actual economy of such an undertaking would soon become apparent.

Some prominence has lately been given to the idea that the Home Government should subsidise a direct cable between Hong Kong and Singapore; but there are several other links in the chain of telegraphic communication which must be rendered secure before going so far afield. We do not intend to minimise the importance of such a direct cable as that we have alluded to, but we doubt the possibility of maintaining it; for when we consider that for more than 400 miles from Singapore, such a cable would lie in less than 50 fathoms of water, and that for about 100 miles from the Hong Kong end the same shallow water would be found, it seems to us that not only would it be absurd to expect such a cable to remain unharmed in war time, but, further, that it would simply be supplying an intelligent enemy with a reserve stock of cable which it would probably suit his purposes to pick up and lay where it might be more useful to him. To damage this cable would neither require much skill nor preparation, for our readers may recollect how the existing cables have suffered at the hands of the ordinary Chinese junks in these waters.

## SECONDARY BATTERY TESTS.

OF late, the conflicting statements regarding the capabilities of secondary batteries have been so numerous that anything approaching authenticity will no doubt be hailed with delight by not a few. We (*Electrical World*) present to our readers, therefore, the report of tests made of two secondary batteries exhibited at Philadelphia last year; but even these must be taken for what they are worth, as they by no means give all the information desirable, which fact, however, is not due to any fault of the examining committee.

Three secondary batteries were exhibited, but of these only two were tested, and they were those of the Railway Light and Power Company and the Brush Company.

The battery tested for the Railway Light and Power Company consisted of 34 cells, each 11 by 12 by 3 inches, containing four plates each, 9 by 10 by $\frac{3}{16}$ inches. The plates are formed by Faure's process, red lead being compressed into an excavated surface. This battery was charged by a Weston dynamo, and was used at the

Exhibition to run six or eight incandescent lamps of different resistances.

It was discharged by the committee on the evening of October 8th, until the electromotive force at the poles on closed circuit was 44·14 volts, and was recharged and again discharged between the morning and night of the following day. The installation of the battery was very bad. The connections between the plates were made by lead bolts which could not be properly tightened, and the battery was placed on a carpet which was kept continually moist by the acid spray thrown up by the bubbles of gas produced toward the close of the chargings. These faulty conditions may account for the low efficiency found for the battery.

The discharge was effected through a resistance consisting of 16 Weston lamps. When the discharge was stopped on October 8th, the electromotive force on closed circuit was 44·14 volts, on open circuit 53·5 volts. On October 9th, after verifying the electromotive force, the battery was charged with 299376·825 volt-ampère-minutes. The discharging was then begun, and an energy representing 159659·649 volt-ampère-minutes had been expended in the lamp resistance before the electromotive force on closed circuit had fallen to 44 volts—the potential at the poles while the battery was doing work at the close of the discharge in the morning. The efficiency of the battery was therefore

$$\frac{159659 \cdot 649}{299376 \cdot 825},$$

or 53·66 per cent. in its delivery of energy compared with the energy required for charging.

The fall of potential in this battery was very unevenly distributed among the cells. On beginning the discharge at 5.30 p.m. on October 9th, the electromotive force of the separate cells was uniformly 1·9 volts. Between this time and 7.15 p.m. the electromotive force of the battery fell from 64·2 to 60·19 volts, the potential of the separate cells taking equal part in the fall. At 7.30 a difference in potential became apparent among the cells, and the electromotive force began to fall rapidly. One cell was at 0 potential at 8 o'clock, three at 8·15, four at 8.30, and five at 9.10, while the electromotive force of the other cells was but little below that at starting the discharge.

The battery was charged during four hours and 48 minutes, at the average rate of 1039·5 volt-ampères. It yielded during discharge for four hours and 10 minutes the average rate of 638·6 volt-ampères.

From 786·45 volt-ampères, which was maintained sensibly constant during the first hour, the delivery fell to 699·36 at the end of the second hour, 557·57 at the end of the third, and 416 at the end of the fourth.

The results of the first test of this battery convinced the committee that the cells were in such a condition that any further measurements and tests for holding charge would be entirely devoid of scientific interest, and of no benefit to the Institute or the exhibitors.

The secondary battery tested for the Brush Electric Company consisted of 19 cells, each containing three plates 16 by 16 inches, the total weight of lead per cell being about 100 lbs. These plates are said to be formed by the Planté process, alternating currents being passed between cast lead plates immersed in dilute sulphuric acid. The cells were in good condition, and the connections of the plates were soldered.

The Carpentier voltmeter used was calibrated by this battery, and the readings being 1·91 volts per cell throughout the whole scale employed, were considered sufficiently exact.

On October 12th the battery was discharged through 41 Swan lamps in parallel circuit, until the difference of potential at the terminals had fallen to 29 volts, the current flowing being then 38·25 ampères. Before starting to recharge on October 13th, the electromotive force on open circuit was 36·3 volts, and with 40 lamps in the circuit 29·8 volts. The re-charging was then begun at 9 a.m., and was continued until 10 p.m. of the same day, with an interruption of 59 minutes, due to an accident to the engine.

After charging the battery it was discharged through 43 lamps. The electromotive force on open poles was 38 volts; with the lamps in circuit 34 volts. The current passing through the lamps was 46·75 ampères.

The tests showed that 562202·25 watts were required to charge the battery from a potential of 29 volts on closed circuit, while in discharging down to the same point 390454·625 watts were obtained. The efficiency ratio is therefore

$$\frac{390454 \cdot 625}{562202 \cdot 250},$$

or 69·45 per cent.

The columns of the table showing the fall of potential and the energy obtained from the battery, indicate that while there is a gradual weakening of the whole battery, the principal falling off is due to the sudden weakening of individual cells, and that the latter do not run down uniformly.

The test of the brush secondary battery was sufficiently severe, as the charging was done with a somewhat heavier current than is usually recommended for the purpose, and the discharging was at an exceedingly rapid rate. It was, therefore, decided that after the test for holding charge had been made, the battery should be recharged and discharged through a smaller variation in electromotive force, but at a slower rate.

The battery was recharged on October 16th, and locked up by the committee, who held the keys for ten days. In the meantime the committee had been requested to return the instruments which had been placed at their disposal. As the Franklin Institute authorities could not guarantee that the instruments would again be placed in their hands for the resumption of the tests before the battery was required to be moved, the committee decided that it was not advisable to prolong work for which the facilities had been withdrawn. With the consent of the Brush Company, further tests were therefore abandoned.

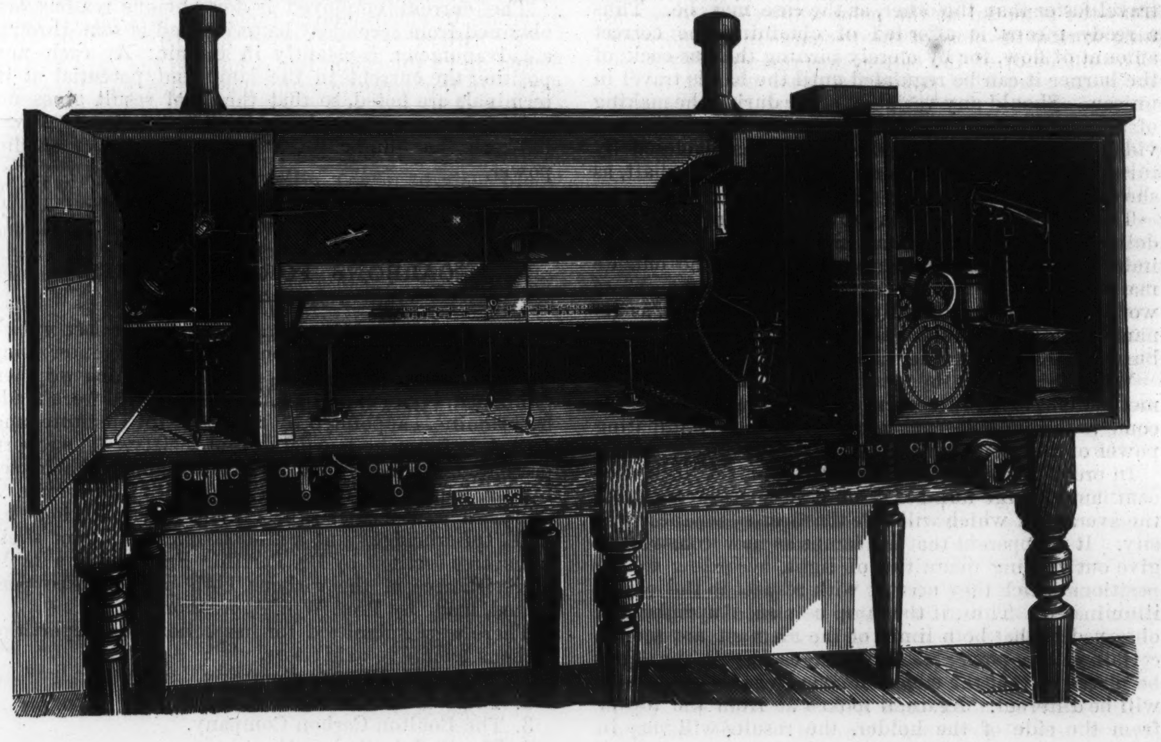
## PHOTOMETRICAL MEASUREMENT OF INCANDESCENT LAMPS.

WHEN we come to the photometer, we are brought face to face with an instrument which requires to be applied in a most critical manner, in order that it may give results of any value whatever. As in other physical measurements, light requires a standard of comparison, and this most essential element alone was, until quite recently, a thing of very uncertain character. In this country and in England the standard spermaceti candle supplied the place of a standard. In France, and to some extent in Germany, the Carcel lamp, burning colza oil, and having a value of about 9·8 candles, served as the standard of comparison; while in Germany the paraffin candle was largely employed as such. In addition to this, numerous others, such as gas standards, have been employed, so that uniformity may be said to have been out of the question. This state of affairs, experienced almost from the beginning of electric lighting on a commercial scale, attracted the attention of electricians, and several electrical congresses have sought in vain to establish some acceptable standard. But it was not until the past year that any definite action was taken in the matter and a standard adopted. This standard, it will be remembered, is the light emitted at right angles from a surface of molten platinum one square céntimetre in area. Here we have a standard, it is true, but one against which several objections have been raised, one of the most important being that it is difficult of practical application. While this is true, it does not carry the weight which some would make it appear to. A standard of fixed character once determined upon, derived or secondary standards can be easily devised which can be verified by the original as often as necessary.

Besides the element of uncertainty which has existed in regard to the standard, there are a number of other troubles which appear on comparing lights of different luminous characters. Thus in comparing the brilliant arc light with the flame of a Carcel lamp, for instance, an error is introduced on account of the different colours of the lights, white and yellow. It is the eye which in this case is variably affected, so that in such cases special allowances must be made in order to get accurate results. In most optical photometrical measurements, the eye is constituted judge of a particular condition of illumination, and it requires a special training and to a certain extent always introduces a source of error, which can only be reduced by taking a large number of measurements and averaging the results.

This uncertainty of the eye in judging has given rise to other methods of comparison, among these being chemical photometers which depend for their action upon the effects of light on certain substances. Still another is the selenium photometer, the operation of which depends on the change in resistance effected upon selenium by the action of light.

Of the numerous photometers which have been proposed and constructed, that of Bunsen may be said to have come into the most extended use. The action of this instrument is based primarily on the well-known law that the intensity of illumination of a surface varies as the square of the distance from the source of light. It further depends upon the fact that a grease or oil spot upon a sheet of paper disappears when both sides are illuminated to the same degree.



Such a photometer is the one shown in our engraving, taken with the description from the *Electrical World*, which represents the instrument employed by Mr. Weston in his laboratory at Newark, N.J., for determining the illumination of his incandescent lamps.

In the centre of the apparatus, which was exhibited at the Philadelphia Electrical Exhibition, will be seen a funnel to which the eyes are applied, and which shuts out any extraneous light that might be diffused in the dark room where all such measurements are made. This funnel is attached to a small carriage which can be slid along the scale, and upon which is mounted a sheet of paper having at its centre a grease spot in the form of a star. Finally, two mirrors are placed respectively at angles of 45° on each side of the paper, so that by looking into the funnel an image of either side of the oiled spot is reflected directly into the funnel and to the eye of the observer.

Directly below the gallery in which the carriage slides is the scale, which is so graduated that the ratio of the candle-powers is read off directly. The centre of the scale is marked by a plumb line. So also the carriage is provided with two plumb lines, one in the front and the other in the rear. These travel with the former, and by reading the scale when the two lines coincide, all errors of parallax are avoided. In using the apparatus, the carriage is slid to the right or left, as the case may be, until the spot disappears, *i.e.*, until the star has the same white hue as the surrounding portion.

We now come to the source of illumination which acts as the standard of comparison, and which is placed at the right end of the gallery in which the carriage slides. The standard employed in this case is what is known as the Methven burner, and comes under the class of gas standards mentioned above. In place of it the standard candle may be employed, but the inconvenience attending its use, especially where a protracted series of experiments is undertaken, as in incandescent lamp determinations, has led to its almost total abandonment for this purpose. Among these reasons we may mention that constant corrections must be allowed on account of the varying rate of consumption of the candle. Again, the various conditions of the wick have a very marked effect upon the resultant light; so that for a large number of determinations the labour of calculation is very great, while the keeping in order of the wick is a constant source of anxiety and uncertainty in the results. For these and other causes a standard of a more permanent nature is desirable, and the Methven burner more nearly fulfills this requisite of permanency, provided certain precautions are taken.

This admirable burner is based upon the observed fact that the *quantity of light* which would pass through a vertical slot $\frac{1}{4}$-inch wide and 1 inch long, in an opaque screen, at a definite height from the base of an argand flame three inches long, or very nearly so, *was equal for all qualities of gas*, and certainly so for qualities of gas between 15 and 35 candle-power. The burner employed is the London argand No. 1, and the screen is placed very near to and at a fixed distance from the burner.

It is evident that this standard of comparison is one of remarkable constancy, and that it is for this reason its use is extending daily. Our illustration shows the burner, which is of the argand type, and has rigidly fixed to it a brass screen with an oblong slot. This exposes a part of the flame, the illuminating power of which in the present instance is two candles. With accurate construction it is evident that the Methven burner is practically independent of the quality of the gas furnished by various companies, requiring only occasional verification for the sake of precaution. Its use, however, entails keeping the flame in a fixed condition; in other words, it requires that the rate of consumption of gas by the burner shall be fixed and constant. In this case five feet per hour is the rate demanded.

It is for the purpose of securing this uniformity that the apparatus inclosed in the compartment at the right of the table is employed. This cabinet contains a gas meter, pressure gauge, and pressure regulator.

On the dial of the meter there will be seen two pointers. One of these revolves in connection with the recording mechanism of the meter proper, but the other is independent of and is driven by clockwork. Gas passing through the meter at the rate of five cubic feet per hour will revolve the meter hand at a certain rate, and the clockwork is so regulated that its hand revolves at the identical speed. Now, if the correct quantity of gas passes, these two hands will revolve in unison; if not, the gas hand will either fall behind or travel faster than the other, as the case may be. Thus a ready means is afforded of obtaining the correct amount of flow, for by merely turning the gas-cock of the burner it can be regulated until the hands travel in unison. Should any variation occur during the making of a test, it can be allowed for. The burner is provided with a cock, which can be opened and closed by turning a milled nut upon a screw-threaded shaft, as shown in the cut.

The pressure regulator is provided for the purpose of delivering the gas to the meter at a uniform pressure independent of the pressure existing in the outside mains—an essential element where steady and accurate working is sought. Finally, the pressure-gauge, as its name indicates, gives the pressure of the gas fed to the burner, and according to which the regulator is set.

With this much by way of explanation of the method employed in securing a uniform standard, we come to the incandescent lamp itself, the illuminating power of which is to be measured.

In order to arrive at the true value of the incandescent lamp a large number of observations are required, the average of which will give the mean spherical intensity. It is apparent that the lamps as now constructed give out varying quantities of light, according to the positions which they occupy with respect to the object illuminated. Thus, if the lamp be placed upright and observed so that both limbs of the filament are seen, a certain candle-power will be the result. If the lamp be placed so that the edges alone are visible, the result will be different. Again, if looked at from the top or from the side of the holder, the results will vary in each instance, and for each intermediate position between these the illumination varies. If we conceive the lamp to be placed in the centre of a sphere, it will be apparent that under such conditions the interior surface of the sphere will be unequally illuminated. By measuring the intensities of the various parts, we can obtain an average which will be *mean spherical intensity* of illumination. In other words, we obtain the average illuminating power of the lamp in all directions.

In actual practice this is obtained by measuring the lamp in a large number of positions, and in taking the mean of these. Our illustration shows the method adopted for this purpose. The lamp is fitted to a universal joint and mounted on a plate, the periphery of which is graduated to degrees. This, in its turn, is pivoted to the upright shown at the end of the horizontal bar, so that the lamp can be revolved in the vertical plane. A graduated arc, fixed to the upright, indicates the angle of revolution. The horizontal bar rests upon a supporting table, and can be slid to and fixed at any point. The supporting table is graduated, as will be seen, and can be raised and lowered so as to bring the lamp in the correct position for observation.

This arrangement permits the lamp to be placed in every conceivable position, each one of which is indicated on the graduated arcs. It would, of course, consume too much time, and the result would not be appreciably bettered, to measure the lamp at exceedingly small changes of position, so that in actual practice the difference between successive positions varies from 3° to 45°, according to the nature of the position. Readings are taken with the lamps in the vertical and horizontal positions, and also inclined as shown in the engraving. It is obviously essential to have the lamp always at the same distance from the oil-paper diaphragm, and to insure this two plumb lines are provided, which permit the lamp to be kept at a constant distance.

Although distinct in themselves, the electrical measurements are so intimately connected with the photometrical, that this description would be incomplete without mention being made of them. The photometer table, as will be seen, is provided with plugs and switches for changing the current in the lamps by introducing resistances. Toward the left is a push button by which the operator signals the person in charge of the electrical tests, which are made simultaneously.

The current employed is for obvious reasons best obtained from secondary batteries, and is sent through a galvanometer constantly in circuit. At each new position the current in the lamp and potential at its terminals are noted, so that the final result gives not only the mean spherical and horizontal candle-power, but also the number of watts consumed per candle-power.

## CARBONS FOR ARC LAMPS.

THIS report, to which we alluded in our last week's issue, will probably be found even more interesting than the results of the arc lamp tests which we then published. The experiments here recorded were made by examiners appointed by the Franklin Institute, and are taken from the journal of that society. The report, presented only last month, includes chemical analyses by Dr. Dudley, Prof. Greene and the chairman, a thorough series of specific gravity determinations by A. E. Outerbridge, jun., a microscopical study of their transverse sections by Dr. Persifor Frazer, and a table of resistances of the carbons, both plain and copper-coated, made by Prof. Wm. A. Anthony.

There were submitted for inspection and report the carbons from five exhibitors, viz.:

1. The Brush Electric Company.
2. The Wallace Carbon Company.
3. The Boulton Carbon Company.
4. The Buffalo Carbon Company.
5. The Carré carbons, manufactured by Emile Levy, Paris, and exhibited by Messrs. J. W. Queen & Co.

Of these, the Brush, Wallace and Boulton companies submitted plain and copper-coated carbons, the Buffalo Company a homogeneous carbon, both plain and copper-coated, and, in addition, a carbon with a core of pure graphite inserted in a sheathing of coke and a carbon with a vitrified coating, while Queen & Co. offered only the uncoated Carré carbons.

It was determined to have chemical, physical and mechanical studies made of these carbons, but the study of the physical characters, resistance, duration of burning in the lamp under different conditions of current, &c., was handed over to the Section on Arc Lights, whose chairman, Prof. William A. Anthony, agreed to take this part of the work.

[A report on the resistance tests came in after this was written, and is appended.]

The chemical and mechanical study was apportioned out among the members of the Section who now present this report, and included determinations of the percentage of carbon, hydrogen and ash, with a qualitative examination of the chief constituents of the latter in the several plain or uncoated samples, the amount of copper on the coated carbons, both absolutely by weight and relatively per unit of length; specific gravity determinations on the uncoated carbons, both with sections of the solid carbons of given length and with the pulverised material; and, lastly, a microscopical study of the structure of the carbon pencils, using for this purpose specially prepared thin cross-sections. The aid of micro-photography has also been availed of in this latter case for the proper illustration of the results.

1. *Determination of the percentage composition of the uncoated carbons* (carbon, hydrogen and ash).—This was undertaken by Prof. Samuel P. Sadtler, and was made to include five samples, viz., the plain Brush, Wallace and Boulton carbons, the plain solid Buffalo carbon and the Carré carbon. The Buffalo carbon with the graphite core was not analysed, as the agent of the company said that the sheathing was made exactly of the same materials and by the same methods as the solid carbon exhibited, while the pure graphite core had a sufficiently well-known composition.

The greater part of a single pencil having been reduced to fine powder, the material for analysis was taken from this stock. The determinations were made by the methods of ultimate analysis, using an open tube, three-fourths filled with granular cupric oxide, placing the weighed material in a platinum boat, and conducting over this a slow stream of oxygen. In this way, besides the carbon and hydrogen determinations, the ash could be accurately weighed, and a check established upon the whole.

The results were as follows:

| | BRUSH CARBONS. | | | WALLACE CARBONS. | | |
|---|---|---|---|---|---|---|
| | I. | II. | Average. | I. | II. | Average |
| Carbon ... ... | 97·61 | 97·81 | 97·71 | 95·92 | ... | 95·92 |
| Hydrogen... ... | 1·32 | 1·22 | 1·27 | 1·15 | 0·97 | 1·06 |
| Ash ... ... | 0·64 | 0·61 | 0·63 | 2·94 | 2·80 | 2·87 |
| Occluded air or loss | 0·43 | 0·36 | 0·39 | ... | ... | 0·15 |
| | 100·00 | 100·00 | 100·00 | 100·01 | | 100·00 |

| | BOULTON CARBONS. | | | BUFFALO CARBONS. | | |
|---|---|---|---|---|---|---|
| | I. | II. | Average. | I. | II. | Average |
| Carbon ... ... | 98·19 | 98·24 | 98·21 | 97·68 | ... | 97·68 |
| Hydrogen... ... | 0·72 | ... | 0·72 | 1·51 | 1·60 | 1·55 |
| Ash ... ... | 0·87 | 0·88 | 0·87½ | 1·09 | 1·08 | 1·09 |
| Occluded air or loss | 0·22 | ... | 0·19 | ... | ... | ... |
| | 100·00 | 99·12 | 99·92 | 100·28 | | 100·32 |

| | CARRÉ CARBONS. | | |
|---|---|---|---|
| | I. | II. | Average. |
| Carbon ... ... ... | 95·98 | 95·84 | 95·91 |
| Hydrogen ... ... ... | 1·00 | 0·73 | 0·86 |
| Ash ... ... ... ... | 1·91 | 1·83 | 1·87 |
| Occluded air or loss... ... | 1·11 | 1·60 | 1·36 |
| | 100·00 | 100·00 | 100·00 |

In looking at these figures, several points of interest at once present themselves.

The Brush carbons have the smallest ash of the series. On account of their rather more open and porous structure, there is room for occluded air in this case, as the result shows.

The Wallace carbons have the largest amount of ash of the series. The character of this ash will be noted farther on by another member of the committee. This carbon is closer in structure than the Brush carbon, being made in an entirely different way, and there is no occluded air to look for.

The Boulton carbons, though having a higher percentage of ash than the Brush carbons, have a higher carbon and a lower hydrogen percentage, possibly having been burned at a higher temperature.

The Buffalo carbons show a distinctly higher percentage of ash than the Brush or the Boulton carbons. The hydrogen percentage as given is possibly a little too high, as the summing up seems to show.

The Carré carbons show a large ash, although considerably less than the Wallace carbons. The porous structure of these hydrocarbons offers, no doubt, a partial explanation for the relatively large percentage of occluded air and loss.

2. *Determination of the percentage of ash and qualitative examination of same.*—This was undertaken by Dr. Charles B. Dudley, and the examination was made upon a portion of the same pulverised material as that used by Prof. Sadtler in the combustion analyses. The results were as follows:—

The Brush carbons yielded 0·478 per cent. of ash. A qualitative examination showed that the portion insoluble in acids was slight; that there was a considerable amount of ferric oxide and a trace of magnesia.

The Wallace carbons yielded 2·672 per cent of ash. A qualitative examination showed a large insoluble residue and a large amount of the oxides of copper and iron.

The Boulton carbons yielded 0·892 per cent. of ash. A qualitative examination showed a small insoluble residue only, a large amount of ferric oxide and a trace of magnesia.

The Buffalo carbons yielded 1·104 per cent. of ash. A qualitative examination showed a small insoluble residue, much ferric oxide, and a trace of magnesia.

The Carré carbons yielded 2·086 per cent. of ash. A qualitative examination showed considerable insoluble residue, much ferric oxide, and considerable lime.

It will be seen that these ash determinations correspond quite generally, in some cases with great exactness, to those gotten in connection with the combustion analyses of the carbons.

| Sample. | Length of coating. | Copper on length of 4 cm. | Copper per centimetre. | Total copper (not including that on end). |
|---|---|---|---|---|
| | | Grammes. | Grammes. | Grammes. |
| Brush carbon ......... | 281 mm. | ·1621 | ·040525 | 1·1388 |
| Wallace carbon......... | 297 ,, | ·0180 | ·0045 | 0·1337 |
| Boulton carbon......... | 272 ,, | ·1853 | ·046325 | 1·2600 |
| Buffalo solid carbon... | 262 ,, | ·1010 | ·02525 | 0·6616 |
| Buffalo core carbon ... | 253 ,, | ·1525 | ·038125 | 0·9645 |

3. *Determinations of copper on the copper-coated carbons.*—These were made, by Prof. Wm. H. Greene, upon the samples of the Brush Company, the Wallace Company, the Boulton Company, and both the homogeneous and graphite-core carbon of the Buffalo Company. No copper-coated sample of the Carré carbon was exhibited. The results are given in tabular form.

4. *Specific gravity determinations.*—These were undertaken by A. E. Outerbridge, jun., and were made upon the uncoated carbons of the Brush, Wallace and Boulton Companies, the French Carré carbon and the plain, the graphite-core and a glazed carbon of the Buffalo Company.

A superficial examination of these carbons showed that some of them were much more porous and of coarser grain than others; it was thought advisable, therefore, to make two different determinations of each sample, one for the purpose of ascertaining the specific gravity of the pencil and the other the specific gravity of the material of which the pencil is composed,

For the first method the samples were all cut to the same length, viz., 5 centimetres. These were first heated to a moderate temperature to expel the moisture absorbed in their pores and further dried in a desiccator; when quite cool they were weighed upon a delicate analytical balance, sensitive to less than one-tenth of a milligram. The pencil was then coated with shellac varnish to prevent the absorption of water when immersed. When the thin coating of shellac was hard the sample was suspended from the beam by a filament of silk and re-weighed; this was the weight used in the specific gravity determinations. The sample was then immersed in a beaker glass of distilled water at 60° F. and weighed. The specific gravity of the pencil was then determined by the usual calculation.

In order to determine the specific gravity of the material of which the pencils are composed, it was first ground to a fine powder in a steel mortar, put through a "No. 80" sieve, warmed to expel moisture, dried in the desiccator and weighed. The weight taken in this case was usually two grammes. The specific gravity bottle which was used in these determinations was filled each time with distilled water at, or very near, 60° F., and weighed; the water was then poured out, the powder put in, the bottle refilled with water (care being taken that no air bubbles remained) and reweighed; from which data the specific gravity of the sample was determined.

In addition to the above, two other experiments were made, as follows:—The pencil was broken up in the mortar and the finest particles separated by the sieve; the coarser grains were weighed, thrown into distilled water and boiled. The water was then cooled down to 60° F., the granules transferred to the specific gravity bottle and a new determination made. In both cases the specific gravity was much higher than that of the finely powdered portion of the same sample, as will be seen from the tabular statement appended. This would seem to indicate that some volatile gas was driven off during the process of boiling.

A further observation was made, viz., that the material composing the pencils is not of uniform density. When the sample is finely powdered, thrown into water and stirred with a glass rod, a portion sinks, but another portion (somewhat like an oily scum) floats upon the surface. This is doubtless some pitch or tar compound used to cement the materials together. Most of the carbons used in actual practice are coated with a superficial layer of copper, and as this would render specific gravity determinations of no value, the plain carbons only were used with the exception of one sample exhibited by the Buffalo Company, covered with a coating of borate of lead. There was also a carbon pencil examined having the peculiarity of a central core (resembling graphite) a little larger in diameter than the core of an ordinary lead pencil.

It was noticed when these different determinations were tabulated that the specific gravity of the powdered carbon was (as might be expected) in each case greater than that of the pencil, and furthermore that the pencils showing the highest specific gravities were not made from the densest materials. Considerable difference was also noticed in the hardness of the different samples.

The figures given in these tables are the average of two weighings of the same sample after drying.

CARBON PENCILS.

| Name of sample. | Length. | Weight. | Specific gravity. |
|---|---|---|---|
| Brush........................ | 5 centimetres. | 7·8035 grms. | 1·526 |
| Wallace........................ | do. | 8·5667 „ | 1·571 |
| Boulton........................ | do. | 7·7162 „ | 1·516 |
| Buffalo—plain........... | do. | 7·7272 „ | 1·523 |
| Buffalo—graphite core | do. | 7·0540 „ | 1·415 |
| Buffalo—vitrified ...... | do. | 8·5961 „ | 1·598 |
| Carré ........................ | do. | 8·6091 „ | 1·506 |

GROUND CARBON.

| Name of sample. | Weight. | Specific gravity. |
|---|---|---|
| Brush ..................... | 2 grms. | 1·587 |
| Wallace ..................... | do. | 1·806 |
| Boulton..................... | do. | 1·606—1·540 Average, 1·573 |
| Buffalo—graphite core | do. | centre core, 1·699<br>exterior, 1·594 |
| Buffalo—vitrified ...... | do. | 1·865 |
| Carré..................... | do. | 1·885—1·914 Average, 1·8995 |

The following table shows the specific gravity of the two coarsely powdered samples which were boiled in distilled water:—

| | | |
|---|---|---|
| Brush carbon...... | 2 grammes taken...... | sp. gr., 1·908 |
| Carré .............. | do. | sp. gr., 1·982 |

5. *Microscopical examination of thin transverse sections of the carbons.*—This was made by Dr. Persifor Frazer, and yielded the following very interesting results.

The examination of the five thin sections of the electric light carbons submitted was undertaken with an 8–10 Zentmayer lens and a Beck parabolic reflector.

The sections were in fair order (with the exception of some dirt on the inner surfaces of the cover glasses) except that No. 5 was broken across the cover glass, and the latter as well as the carbon section detached from the slide.

No. 1 was taken from a Brush carbon.
No. 2 was taken from a Wallace carbon.
No. 3 was taken from from a Boulton carbon.
No. 4 was taken from the Buffalo Co.'s carbon.
No. 5 was taken from the Carré carbon.

The preliminary examination was made without a reflecting mirror and with a low eye-piece giving a magnifying power of about 50 diameters.

No. 1. Under these circumstances No. 1 presented an opaque surface except in a few spots where the film was torn away, and a few translucent particles. The colour of its surface was silver gray, with foliated masses of carbon of decidedly graphitic appearance distributed through the field.

Under the reflected light of the parabolic mirror the substance of the section, though of coarser structure than appeared in the other slides, seemed of considerable constancy of composition.

The largest grains were about 0·1 mm., and the smallest 0·03 mm., the latter measurement quite accurately representing the size of the pores. All the bright spots are surfaces showing high metallic lustre and gray colour, with lines of striation and fracture.

No. 2. Without the reflector No. 2 presented the appearance of a fine-grained surface covered with small rounded nodules or minute botryoidal masses, and showed little if any traces of foliation or crystallisation.

Under reflected light (and exposed on the underside to a parallel beam) the largest opaque grains were 0·03 mm., and the smallest 0·015 mm. The average size of the opaque grains was 0·02 mm. These are, in a rough estimate, from 1 to 2 per cent. of visible foreign matter in the carbon in the form of grains of various substances (which are generally translucent) in the carbon. Some of these reach a size of 0·1. There are fewer pores in this than in No. 1, but those which exist are larger.

The largest part of the substance is very fine grained, but large dark gray angular discs are very generally distributed throughout the mass. In the photograph these dark gray flat bodies are visible, and the constituent parts of the fine mass are less sharply defined and separated. But, in fact, the photograph cannot give either the colour or the lustre of the original, and is mainly useful in giving an idea of the texture of the surface.

No. 3. Without the reflecting mirror No. 3 showed an extremely fine-grained texture with comparatively few and quite small points of silver-gray colour and metalloid lustre.

Under the mirror the grains measured from 0·05 to 0·02.

The texture was extremely fine-grained and compact, and the structure exceedingly homogeneous. The colour of the surface was a lighter gray than that of any of the other slides, and was tinged yellowish in irregular blotches which may, however, have been the result of the accidental addition of a foreign body in mounting. Occasional translucent oblong particles were seen measuring 0·1 mm. to 0·05 mm. along their longer sides.

The surface exhibits small and large masses of slightly greenish colour, attached to each other and nowhere separable into distinct grains. The smallest of these constituent parts are not so small as those of the matrix of No. 2 ; and the largest, not as large as the dark angular fragments in the same slide. The structure is nowhere compact, but loose and spongy. There are visible a few small striated particles of irregular outline.

No. 4. Without the mirror the texture appears very fine, but little granular in character. The very small points of steel-gray colour of graphitic aspect are less numerous than in 2 and 3.

With the reflector the grains varied in size from 0·01 mm. to 0·03 mm., the average being rather nearer to the first measurement. The colour was a somewhat darker gray than that of No. 3, and the number of very minute particles of foreign matter was greater; most of these were translucent and measured about 0·02 mm.

No. 5. Examined simultaneously in reflected and transmitted light, No. 5 shows a very large number of holes which have doubtless been caused by the more ready crumbling of certain of its constituent grains. Those of the latter which are opaque measure from 0·02 mm. to 0·01 mm. The grains are not so fine as in the last specimen, and the structure seems to be less homogeneous.

From the existence of numerous very fine points of various colours in transmitted light, and the existence of the holes formerly mentioned, it would seem that the powdered carbon has been mixed with very fine sand or earth, either accidentally or purposely, before having been moulded into sticks.

The ground mass has a fine grained dark greenish appearance, of the same character as that of 3 and 4, *i.e.*, resembling a surface of a decomposing mineral. A number of dark gray, flat, angular objects are scattered through the mass, as in No. 2.

## RESISTANCES OF ARC LIGHT CARBONS.

The following measurements of resistances of electric light carbons were made at Cornell University last winter. The carbons were selected at random from those which Professor Sadtler procured for tests, and probably represent a fair average.

The method pursued in measuring the resistances was as follows :—The carbon to be tested was connected in circuit with a piece of very uniform German silver wire, a known length of which measured $\frac{1}{10}$ ohm. To connect the carbon in the circuit, a hole, which the carbon fitted tightly, was bored in the side of a wooden block, and a second hole bored from the top of the block to meet the first. Such a block was fitted upon each end of the carbon and the vertical holes filled with mercury. Into this the connecting wires were placed. The resistance of the carbon was determined by obtaining, upon the German silver wire, points having the same difference of potential as points on the carbon near the two ends. Measuring the distance between these points on the German silver wire, and comparing with the known length for $\frac{1}{10}$ ohm, gave the resistance of the carbon. To determine the points of equal difference of potential, a Thomson galvanometer of 10,000 ohms resistance, differentially wound, was used. The coils were adjusted so that no deflection occurred when the same current flowed in opposite directions through them. Their resistances were also adjusted to exact equality. The terminals of one pair of coils were then connected with points near the ends of the carbon, and the terminals of the other pair with sliding contacts on the German silver wire. The method of using the instrument will now be evident. It was far more sensitive than was necessary for the purpose, but could nevertheless be used with great facility. The measurements were made by Mr. E. T. Turner, a young man doing some post-graduate work in my laboratory. The results are given in the table below :—

RESISTANCES OF CARBONS.

| No. of Carbons. | Resistances per Centimetre. | Total Resistance of 30 cm. |
|---|---|---|
| | WALLACE (PLAIN). | |
| | ohm. | |
| 1 | 0·0048 | 0·134 |
| 2 | 0·0044 | 0·132 |
| 3 | 0·0047 | 0·141 |
| | (COPPERED.) | |
| 4 | 0·0044 | 0·132 |
| 5 | 0·0031 | 0·093 |
| | BUFFALO COMPANY (VITRIFIED). | |
| 1 | 0·0050 | 0·150 |
| 2 | 0·0066 | 0·198 |
| 3 | 0·0061 | 0·183 |
| | BRUSH (PLAIN). | |
| 1 | 0·00610 | 0·183 |
| 2 | 0·00623 | 0·187 |
| 3 | 0·00672 | 0·222 |
| 4 | 0·00691 | 0·227 |
| | (COPPERED.) | |
| 1 | 0·00108 | 0·0324 |
| 2 | 0·00033 | 0·0099 |
| 3 | 0·00024 | 0·0072 |

| No. of Carbons. | Resistance per Centimetre. | Total Resistance of 30 cm. |
|---|---|---|
| | BUFFALO (PLAIN). | |
| 1 | 0·00625 | 0·187 |
| 2 | 0·0052 | 0·156 |
| | (COPPERED.) | |
| 1 | 0·00221 | 0·076 |
| 2 | 0·00940 | 0·0144 |
| 3 | 0·00075 | 0·0225 |
| | CORED (PLAIN).* | |
| 1 | 0·1413 | 4·239 |
| 2 | 0·1700 | 5·100 |
| | (COPPERED.) | |
| 1 | 0·000422 | 0·01266 |
| 2 | 0·001617 | 0·04851 |
| | BOULTON (COPPERED.) | |
| 1 | 0·00163 | 0·0489 |
| 2 | 0·00218 | 0·0654 |
| 3 | 0·000475 | 0·001425 |
| | CARRÉ (PLAIN.) | |
| 1 | 0·00408 | 0·1224 |
| 2 | 0·00377 | 0·1131 |

* This was a hollow carbon having a core of some different material. To make sure that the high resistance was not a mistake, it was measured also in the ordinary way by the bridge, with the same results.

SAMUEL P. SADTLER, *Chairman Section VI.*,
CHAS. B. DUDLEY, | PERSIFOR FRAZER,
WM. H. GREENE, | WILLIAM A. ANTHONY.
A. E. OUTERBRIDGE, JUN.

## PREVENTING COLLISIONS WITH ICEBERGS IN A FOG.

AN article upon this subject appeared in a recent number of *Science*, and as it is from the able pen of Prof. Alexander Graham Bell, of telephone fame, we reproduce it in the belief that it will be perused with interest by our readers.

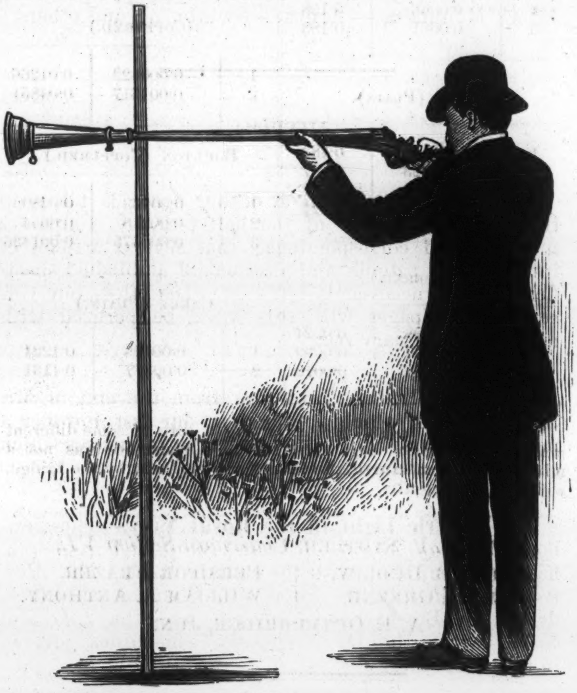
The Professor writes :—The recent accident to the steamer *City of Berlin* emphasises the importance of devising practical methods of ascertaining the proximity of icebergs in a fog. The precautions adopted by Captain Laud, though they saved the lives of more than 1,400 passengers, and prevented serious damage to the vessel, did not prevent contact with the berg. Even the "look-outs" were unaware of the proximity of the iceberg until it was actually upon them.

Under these circumstances, the method proposed by Mr. Frank Della Torre of Baltimore deserves consideration. His experiments indicate the possibility of obtaining an echo from an iceberg when in dangerous proximity to a ship. Mr. Della Torre believes that even an object offering so small a surface as a floating wreck may in this way be detected during a fog in time to prevent collision. However this may be, it is certain that his method is worthy of a careful trial at sea, and that preliminary experiments, recently made in the presence of Prof. Rowland of Johns Hopkins University and the present writer, have demonstrated the feasibility of producing well-marked echoes from sailing vessels and steamboats at considerable distances away.

These experiments were made on the River Patapsco, near the head of Chesapeake Bay, at a point about seven miles from the city of Baltimore. The party proceeded down the river in a steam-launch to the selected place, where the distance from shore to shore appeared to be about three miles.

The launch was kept so far from land as to prevent the possibility of mistaking an echo from the shore for one produced by a passing vessel.

The apparatus employed consisted of a musket to the muzzle of which a speaking trumpet had been attached (see the illustration). The gun was aimed at passing vessels, while blank cartridges were fired. After a longer or shorter time, according to the distance of the vessel, an echo was returned.



The ordinary river steamboats, and schooners with large sails, returned perfectly distinct echoes, even when apparently about a mile distant. At shorter distances the effects were, of course, still more striking.

In order to test the effects under the most disadvantageous circumstances, blank cartridges were fired in the direction of an approaching tugboat. The surface presented, was, of course, much smaller than if the boat had presented its broadside to the launch. As the boat approached bow on, it corresponded to a target somewhere about six feet square, presenting a convex surface to the impinging sound-wave. Even in this case a feeble echo was perceived when the boat was at a considerable distance (estimated to be nearly one-quarter of a mile). That any echo should have been perceived at all under such circumstances, was a surprise. The sound was heard only by the closest attention, but in the case of larger vessels the effects were very distinct and striking.

Experiments were made which demonstrated the fact that the speaking-trumpet attached to the gun was of material assistance in giving direction to the sound-impulse, and in intensifying the audible effect.

Mr. Della Torre claims that a steam-whistle or siren, combined with a projecting apparatus like a speaking-trumpet, will prove as efficient as the gun.

During the experiments on the Patapsco River, a curious rumbling effect, like the rolling of thunder, was often observed, which continued for some seconds. A similar sound was also noticed, as an echo from a well-wooded shore; but the effect alluded to above could not have been due in any way to the land, as the sound commenced immediately upon the firing of the gun, whereas the shore was distant at least a mile or a mile and a half.

The sound was probably due to the presence of ripples on the surface of the water, as the effect was much less marked when the surface was smooth. Such a sound might prove a disturbing element of importance in a rough sea, but would hardly be sufficient to prevent the detection of an echo from a large iceberg. Had shots been fired periodically from the bow of the *City of Berlin*, it can hardly be doubted that the presence of an obstacle ahead would have been discovered in time to prevent the collision that actually occurred.

## THE JABLOCHKOFF BATTERY.

THE interest centreing around primary batteries is considerable, and seems likely to continue unabated. The utmost ingenuity is exercised in the endeavour to produce new types and patterns, and almost every element and every chemical compound under the sun has been at some time or other pressed into the service of the inventor in order to effect the object in view; the results have certainly not up to the present been such as to give much cause for congratulation even in cases where the task has been undertaken by those whose chemical and electrical knowledge would be likely to render success a probability. In many cases, however, the productions have been such as to make one wonder whether the work of such sterling philosophers and accurate reasoners as Faraday, Daniell, Grove and others, is really after all to be depended upon, and in some cases to make one wonder whether the evidences of one's own senses are to be believed or not. In many cases it is difficult to prove the fallacy of an invention from the absence of sufficient data from which to deduce the same. In the case of the latest invention of M. Jablochkoff such data are wanting, and it is therefore practically impossible to prove the fallacy by an appeal to published figures. Generally speaking, we are called upon to believe that a zinc-carbon battery, the zinc of which has been short circuited with a second piece of carbon for a certain period, is a far more efficient arrangement than a battery in which this short circuiting has never taken place. In order to draw a fair conclusion from experiments, it is of great importance to draw a comparison from actual competition, and this, as far as we can see, has not been done. It is quite possible that a partially exhausted battery may retain sufficient vitality to give a vigorous current for a comparatively long period, but unless a comparison be made with a known form of element, equal, as far as possible, in size, weight, &c., to the one under test, and it be shown that the known form has failed to do what the new invention can effect, very little reliance can be placed on the results obtained. As far as can be judged, the new element of M. Jablochkoff effects nothing which may not at least equally well be effected by many known forms of batteries. A contemporary points out as an advantage of the Jablochkoff element "the total absence of all fumes and acid liquors . . . . and immunity from creeping;" these points, it is stated, "appeal at once to all who have ever used batteries for ordinary purposes, such as ringing bells, working telephones, and the like." We must confess that the information that batteries for ringing bells or for telephonic purposes give off fumes and are charged with acid liquors is quite new to us. The battery is stated to be practically a hydrogen-oxygen couple, the hydrogen being generated by the local action of zinc or other metal in a carbon tray; it is stated, however, as a *curious fact*, that the electromotive force of the element is different with different metals. How this can be reconciled with the statement that hydrogen is the active element it is difficult to see. The "curious fact," in our opinion, is a plain proof that the action is due to the oxidation of the metal as in any ordinary battery. But we find it stated that a proof of the fact that the electromotive force of the battery is due to the hydrogen and not to the metal, is that "when a cell has been charged, the tray may be washed out to remove all the metal, the cell put together again, and after that it will be found that a powerful current is given off." With reference to this we would point out that the late Sir Charles Wheatstone found that the full electromotive force could be generated by a metal if but $\frac{1}{1000000}$th part of a grain were present. If a chemical test proved that the mere washing in question had absolutely removed every particle of the metal there might be some ground for regarding the result as curious, but in the absence of such a test the statements can only be regarded as misleading. Of the theories propounded by M. Jablochkoff to explain the actions little need be said; they are simply baseless theories to explain results which have been falsely interpreted by an inaccurate experimenter. Lastly, with reference to the recuperative power of the battery. This power, it is almost needless to say, is one which is more or less possessed by every battery, and which is particularly noticeable in the ordinary Leclanché, the Marie Davy, and the Smee of the Tyer pattern.

## A "DYNAMICABLE" OUTING.

ON Friday, the 19th inst., a number of "Dynamicables" visited the Arc Works at Chelmsford, at the invitation of Messrs. R. E. Crompton and Co. One contingent left London by an early train, in order to participate in a cricket match organised to take place between the younger members of this comparatively youthful society and the "Arcadians," pupils of Messrs. Crompton, who, if they turn out as adept in electrical engineering as they showed themselves to be in handling the willow, should make themselves heard of in the more important walks of life.

The result of the match is here appended:—

### "ARCADIANS" v. "DYNAMICABLES."

Played at Chelmsford, resulting in a victory for the home team by 59 runs. For the "Dynamicables" Messrs Rawson and Defries made a long stand, the batting of Mr. Rawson being very good. For the "Arcadians" Messrs. Albright and Dymond put on 100 runs between them before being separated. Score:—

| "DYNAMICABLES." | |
|---|---|
| Mr. W. S. Rawson, l.b.w. Albright . | 47 |
| " W. Defries, c. Albright, b. Bright | 28 |
| " H. Joel, run out .. .. .. | 0 |
| " Sharp, b. Albright .. .. .. | 4 |
| " W. C. Mountain, l.b.w. Albright | 6 |
| " R. E. Crompton, b. Bowling .. | 0 |
| " C. H. Biggs, c. Dymond, b. Bowling .. .. .. .. | 9 |
| " S. F. Ferranti, b. Albright .. | 3 |
| " W. A. Kyle, not out .. .. | 4 |
| " — Ram, b. Albright .. .. | 1 |
| " F. L. Rawson, b. Albright .. | 0 |
| Extras .. .. .. | 8 |
| Total .. .. | 109 |

| "ARCADIANS." | |
|---|---|
| Mr. J. F. Albright, b. Rawson .. | 48 |
| " M. J. M. Williams. l.b.w. Biggs | 11 |
| " S. Bright, b. Mountain.. .. | 4 |
| " E. R. Dymond, b. Rawson .. | 47 |
| " H. U. T. Foster, b. Rawson | 10 |
| " H. F. Bowling, c. & b. Rawson.. | 10 |
| " F. L. Wilder, b. Biggs .. .. | 3 |
| " I. S. Sorensen, c. & b. Biggs .. | 0 |
| " H. Stevenson, run out .. .. | 1 |
| " W. H. Robinson, not out .. | 1 |
| " P. E. Scrutton, b. Biggs.. .. | 11 |
| Extras .. .. .. | 22 |
| Total .. .. | 168 |

The main body of the visitors left London by an afternoon train, arriving at Chelmsford station about 3·30 p.m., from whence they at once proceeded to the Arc Works, being there met by Mr. Crompton and his pupils, by whom they were shown through the factory.

It does not on this occasion come within our province to describe the interesting details of dynamo machine construction as here exemplified in such a high degree; suffice it to say that all the shops, testing rooms, &c., contained much to interest the electrician and engineer, the Crompton dynamos fitted to "Tower" engines for search light service coming in for a special share of attention.

After dining together at the Saracen's Head Hotel, Mr. Crompton, in the absence of Lord Thurlow, taking the chair, the party left for London, a powerful electric search-light being thrown on the train from the Arc Works as it steamed away to Liverpool Street, which was reached about 10·45 p.m.

The captain of the "Arcadians," Mr. M. J. M. Williams, desires us to express, on behalf of the members of that club, their thanks to the "Dynamicable" gentlemen who brought together the rival team; we, on our own part, think that Mr. Crompton, his partners and pupils, deserve the warmest thanks of the "Dynamicables" for their invitation and also for their kind and courteous attentions which made the visit so thoroughly enjoyable to all concerned.

Amongst the visitors were Prof. W. Grylls Adams, F.R.S., Prof. G. Forbes, Dr. Julius Maier, Messrs. Paxman, Farquharson, Massey, W. S. Rawson, F. L. Rawson, S. L. Ferranti, W. M. Mordey, H. F. Joel, Cromwell Varley, W. Defries, E. Sennett, C. H. W. Biggs, T. E. Gatehouse, W. M. O. Gooch, W. B. Esson, W. T. Glover, G. C. Sillar, H. Alabaster' F. Wynne, T. Browett, E. M. Oakley, T. Parker, S. Sharp, R. Ritchie, W. C. Mountain, — Arnot — Swinburne, and others.

## NOTES.

**Our Columns.**—So much of our space is taken in this, the last number of the half-year, by companies meetings and correspondence, that several articles of interest, new patents, and abstracts of published specifications, are necessarily left over. Doubtless our correspondence pages will, this week, be perused with more than ordinary zest.

**Erratum.**—In the third line from the end of Mr. Sellon's letter which appeared in our last number a misprint occurs. For "the disturbing influences which effect such regularity," read, "affect," &c.

**The Electric Light in the Royal Navy.**—The gunboats *Medway*, *Medina*, *Pike* and *Snap*, at Portsmouth, have been supplied with the electric light. The *Medway* and *Medina* are fitted with Siemens machines, driven by Brotherhood's engines, and the *Pike* and *Snap* with the D2 "Victoria" machines, driven in a like manner.

**Electric Lighting at the Crystal Palace.**—A correspondent of the *Engineer* writes:—The Gülcher lamps at the Crystal Palace illuminated *fêtes* are suspended five or six feet down from the end of a short arm at the top of poles about 40 feet high, placed at various points of vantage in the grounds. From this mode of suspension, as the spectators move about, the upper end of a pole is sometimes between a spectator and the light, and close to the latter. The effect from the Terrace—which is at about the same height as the lamps, and at a distance of some 300 yards in some cases—is somewhat startling under these rather unusual conditions of suspension and view. As one walks along the Terrace there suddenly appears in front and at right angles to a lamp, a luminous cone, lost above in the realms of space; a little farther on the spectator finds himself within a similar but very dark cone of shadow. Standing at the edge, where the cones of light and shadow meet, the effect is very striking and singular, and affords besides a beautiful illustration in miniature of the shadow-cone of a sun eclipse with the penumbra. It may be added that a slight fog may have given additional potency on the night in question to an optical phenomenon, common as candle-light, but not so common under conditions of height and distance of observation, and a partially obscured and powerful electric light.

**The Electric Lighting of the Post Office Savings Bank, Queen Victoria Street.**—"Hibbert *v.* Maxim-Weston Co." This case, which has been looked forward to with considerable interest in electric circles, is down for trial in the Court of Queen's Bench. It appears that Mr. Chas. Hibbert, of the Brush Electric Corporation, who last year was the surveyor to the Maxim-Weston Co., claims a sum of £116 for commission at 4 per cent. upon the above Post Office contract of £2,899, for the lighting of the savings bank. The lighting, which is now proceeding, is to be with 350 incandescent lamps of 20 candle-power, and 350 of 8 candle-power. The motive-power is supplied by three of Crossley's 16-H.P. nominal gas engines, placed in the basement. A guarantee has been given that the maintenance of the installation shall not, for the first two years, exceed £700 per annum. Mr. Hibbert has had considerable experience in electric lighting, having been, we are informed, with the Pilson Co., Jablochkoff Maxim-Weston, Anglo-American Brush, &c., and has been entrusted with several important installations, amongst others the Government contract for the lighting of the Bethnal Green Museum for three years, at £1,000 a year, the lighting of the grounds of the Albert Palace, Battersea, lately completed, &c., &c.

**The Electric Light in Algiers.**—It is contemplated to use the electric light in Algiers for night work during harvest time, in order to escape the heat, which is almost murderous for Europeans, and is an obstacle to their carrying on agricultural work.

**The Electric Lighting Act.**—The *Times*, reviewing the career of the late Ministry and the measures it introduced, remarks :—"The Electric Lighting Act may be an admirable measure, but electric lighting has certainly not prospered under it."

**The Accident to H.M.S. "Leander."**—Striking the Hornet Rock during the practice of the Evolutionary Squadron last week, H.M.S. *Leander* began making water rapidly. The pumps were got to work and continued in operation during the night under the electric light with a successful result.

**Temporary Lighting.**—At the annual dinner held recently at Trinity House, at which the Prince of Wales was present, the rooms were lit by incandescent lamps supplied by the Electrical Power Storage Company, who were called upon to repeat the lighting a few days after. At Mrs. O'Hagan's fancy dress ball photos were taken throughout the evening by Mr. Vanderweyde, who employed a single arc fixed in a curved reflector, the current, 60 ampères, being supplied for over six hours from E.P.S. cells.

**A Big Search Light.**—Last week a number of interesting experiments with a new search light of 25,000 candle-power were made at Messrs. Crompton and Co.'s Arc Electric Works, Chelmsford. It has been made for the Brazilian ironclad *Aquidaban*, and by its illumination objects at sea will be discernable at three miles distance. We believe that this is the same with which the "Dynamicables" were shown the way out of Chelmsford last week. The beam was a most brilliant one, and very free from the straggling rays which are oftentimes seen in connection with projected lights.

**The Grosvenor Gallery Lighting.**—It was stated on Thursday that the Duchess of Westminster would have a dance at Grosvenor House on the evening of that day, when the Rubens Room and Picture Gallery would be thrown open and illuminated by the electric light for the first time.

**Telegraph Revenue.**—The receipts on the telegraph service for the period between April 1st and June 20th, 1885, amounted to £355,000, which sum was also received between April 1st and June 21st, 1884.

**The Plymouth Telephone Exchange.**—The Western Counties and South Wales Telephone Company has announced its intention to fulfil the promise made some months since, and on the 1st of July will open public call rooms at convenient centres in the three towns (Plymouth, Devonport, and Stonehouse). It has also been decided to give subscribers the gratuitous use of a wire to the Post Office, whereby telegrams may be sent or received ; and, furthermore, it has been arranged to open a night service, should the encouragement afforded by the public justify the experiment.

**Amalgamation of Telephone Companies.**—As will be seen in our City columns, an amalgamation has been effected between the Dundee and District and the National Telephone Companies. The fortunate shareholders of the former company have, it seems, during the four-and-a-quarter years since the company was started, divided at the rate of about 9 per cent. per annum, and the purchase price of their property will secure to them a bonus of 40 per cent. on their capital. There are not, as the *Dundee Courier and Argus* wisely remarks, many things so good as that to be picked up now-a-days. This same journal does not think, however, that the public will be quite as well satisfied with the arrangement, as those who have hitherto been subscribers to only one of the exchanges, will have to pay £10 annually instead of £5.

**The Shah of Persia and Telegraphy.**—The Shah of Persia has presented to Colonel Bateman-Champain, R.E., and to Lieutenant-Colonel Murdoch Smith, R.E., two handsome swords of honour, in token of His Majesty's appreciation of the long services rendered by those officers in connection with the establishment and maintenance of the telegraphs in Persia.

**An Auckland-Fiji Cable.**—It is said that it is in contemplation to establish cable communication between Auckland and Fiji. Should this be effected, our most distant colony will be connected with Great Britain by wire.

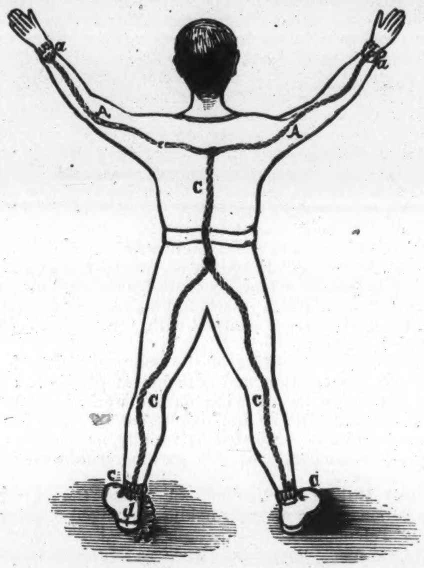
**Secondary Battery Tests.**—The cells of the Railway Light and Power Company, which were tested towards the end of last year, at Philadelphia, do not appear to have been very satisfactorily constructed. Certainly we manage these things better in the old country, as a perusal of the tests given in another column will show.

**Carbons for Arc Lamps.**—The results of tests made recently in the United States, which we publish in our other pages, will be found specially of value to manufacturers on this side of the water. We cannot call to mind any experiments of a similar nature which have been made hitherto, although it is highly probable that Mr. Crompton, who is an authority on carbons, may have investigated this highly important matter to an equal extent. One of the samples under examination, the "Buffalo," is supplied in this country by Mr. C. R. Heap, and we believe that Messrs. Paterson and Cooper act as agents for the "Wallace." The Boulton Carbon we do not hear much of.

**Professorship of Chemistry.**—Professor Ayrton, of the Technical Institute, Kensington ; Professor Dewar, of Cambridge ; Professor Hartley, of Dublin ; Professor Odling, of Oxford ; and Professor Thorpe, of Leeds, are said to be candidates for the professorship of chemistry at South Kensington, vacant by the resignation of Dr. Frankland. The emoluments exceed £1,600.

**Personal.**—Mr. J. Fletcher Moulton, F.R.S., who is well-known in electrical circles for his acquaintance with telephonic and electric lighting matters, has been definitely adopted as the Liberal candidate for the new division, under the Redistribution of Seats Bill, of Clapham.

**Protection from Electrical Shocks.**—A device for the protection of human beings from high tension currents is shown in the illustration. It is the invention of Mr. Patrick B. Delany, of New York, the inventor of the well-known synchronous multiplex telegraphic system, and is the subject of a recent patent. The principle is that should the wearer of the apparatus become interposed in the circuit of a high tension current, the current will be shunted around his body. The parts shown are hand contacts or gloves, *a*, the conductors, A, C, C, the anklets, *c*, and the sole plate, *d*.



This device was suggested immediately after the fatal accident at the Healtheries last year, by Mr. S. A. Varley, but in expecting men to wear such appendages too much is asked.

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**An "Octopus" Torpedo.**—It is stated that a torpedo designated the "Octopus," has been invented by a young non-commissioned officer belonging to the Royal Engineers, at Chatham, who will shortly place the plans in the hands of the Secretary of State for War. The charges are fired by electricity, and it is stated that the torpedo is adapted for the defence of mouths of harbours, rivers, &c., without endangering friendly navigation, and obviating the necessity of recording their position.

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**Scientific Bodies and their Transactions.**—It is almost time that some little attention be called to the papers read before scientific bodies, and which are selected, unwittingly perhaps, for publication in their transactions. The most recent, and one containing, in our opinion, the most glaring examples of misleading statements, is the communication of Mr. F. Geere Howard on Secondary Batteries, just issued under the auspices of the Institution of Civil Engineers. Our Correspondence columns will, without further comment from us, give our readers some idea of the value to be attached to the author's deductions; and, as an amusing instance of "the engineer hoist with his own petard," we will refer them to the advertisement of the Electrical Power Storage Company in our present issue. If Mr. Howard's paper gained the "Miller Prize," what, one may well ask, could have been the practical value of the communications received from non-successful students of the Institute? Professed electricians will give the author's work that meed of recognition it so richly merits; but unfortunately such productions, emanating from a youthful, enthusiastic, and probably, ambitious but thoughtless mind, especially with the endorsement of such a well-known body as the C.E. Institute, will do much, unless checked in time, to give the general public altogether erroneous notions respecting the uses to which new, useful, and, by some people, little understood discoveries may be put.

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**Jablochkoff's New Battery.**—Our readers will, of course, have noticed that in our last week's note respecting this battery, we said nothing as to its electromotive force, constancy, current, &c. Our preliminary idea was to decide whether it did not, by virtue of the local action which goes on independently of the working current, consume more zinc in a given time, and while doing the same external work as an ordinary cell, with which it was compared. We found our expectations realised, and we now purpose trying, if found necessary, some further experiments on the constancy, &c., of this much vaunted primary battery.

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**The Lalande-Chaperon Battery.**—This oxide of copper battery has been adopted by the *Société Générale des Téléphones* of Paris, for their exchange and line service. The cells are found very advantageous, owing to their constancy and duration.

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**Obituary.**—The sudden death from apoplexy is reported of M. Henri Tresca, an eminent French physicist and engineer. He was born at Dunkirk in 1814. He studied at the Polytechnic School, and on leaving it entered the corps of the Ponts et Chaussées. He soon afterwards quitted the service in order to devote himself to scientific study. In 1850 he was appointed principal inspector of the French section of the Exhibition at London. He afterwards became sub-director of the Conservatoire des Arts et Métiers, and he there filled with great distinction the chair of Industrial Mechanics. During the Commune he displayed much courage in shutting the doors of the Conservatoire and preventing the Anarchists from obtaining the cannon in the possession of the establishment. In 1865 he was created an Officer of the Legion of Honour, and in 1872 he was elected a member of the French Academy. Of his numerous works may be mentioned his "Cours de Mécanique Appliquée," and his "Ecoulement des Liquides." The Academy of Sciences, on hearing of his death from the President, M. Boulay, closed the sitting as a mark of grief.

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**Rockets for Erecting Telephone Lines.**—The celebrated old Moorish edifices, Pena Castle and Royal Palace, in Cintra, Portugal, were recently telephonically connected by the Edison Gower-Bell Telephone Company of Europe. As all who have visited the favourite summer resort of Cintra are aware, the castle is built on the summit of precipitous rock mountains, ascent to which is impossible, except by means of the circuitous pathway. The wire employed was No. 14 B.W.G. steel, jointed to a few yards of No. 8, on either side of the insulator; the first of the latter was fixed high up one of the "Champagne" chimneys of the Royal Palace, thence to the ruined Moorish Castle, and thence to the Pena Castle. Those who have visited Cintra can easily understand the enormous difficulties which would necessarily be encountered in passing the line wire over the thousands of trees which cover the intervening ground, and also on account of the dangerous nature of the rocks for any ascent other than by the beaten circuitous track. To overcome these difficulties, a novel innovation in the passing of telephone wire was adopted by Mr. Alan Danvers, the company's engineer. Rockets, with thin cords attached, were fired over the rocks and trees; the line wire being then attached to the cord and pulled after it.

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**Gas Testing.**—Dr. A. W. Williamson, F.R.S., the chief gas examiner of the Board of Trade, has, in conformity with the provisions of the Acts of Parliament, reported to the Corporation the results of the daily testings of gas supplied to the City during the past quarter. With respect to illuminating power the average in standard sperm candles had been, at the Jewry Street testing-place 16·4; at the Clothfair testing-place, 16·4; and at Dorset Buildings, 16·3, which was higher than the parliamentary standard. At King Street, Clothfair, the *minimum* did not fall below that standard, but at the other testing-places deficiencies were returned on fifteen days. The Gas Light and Coke Company appealed against the tests for deficient illuminating power in the gas analysed at Dorset Buildings on January 26 and March 2, which arose from causes beyond the control of the company and the official examiners.

**Connecting Merv with Askabad.**—The Russian papers say that, at the request of General Komaroff, Governor of the Transcaspian region, the Minister of War has recognised the urgency of immediately establishing a line of telegraph connecting Merv with Askabad. This line would pass by Annow, Babadoorma, Bougatchik, Artchigan, and Sarakhs. Its length will be 500 versts, and the expense about 100,000 roubles.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**South Staffordshire Electric Lighting Company, Limited.**—The annual return of this company, made up to the 22nd ult., was filed on the 16th inst. The nominal capital is £100,000, in £5 shares. 139 shares have been taken up, and the full amount has been called thereon, the calls paid amounting to £690, leaving £5 unpaid. Registered office, 33, Waterloo Street, Birmingham.

**Telephone Company of Austria, Limited.**—An agreement, dated 4th inst., and filed on the 20th inst., authorises the allotment of 145 fully paid shares to Mr. Josef Wessely, of Vienna, and 568 fully paid shares to the Consolidated Telephone Construction and Maintenance Company, Limited, in satisfaction of the respective amounts of £725 and £2,840, due by the company to them.

## CITY NOTES, REPORTS, MEETINGS, &c.

### United Telephone Company, Limited.

THE fifth annual ordinary general meeting of this company was held at the City Terminus Hotel, Cannon Street, on Thursday, under the presidency of Mr. James Brand, Chairman.

The report presented was as under :—

Capital Expenditure.—A reference to the capital account will show that up to the 30th April, 1885, the sum of £160,866 15s. 4d. has been expended upon the works in connection with the London exchange system and private lines, and instruments in use in London and in the provinces; being £20,679 11s. 7d. more than the outlay shown in the last balance-sheet.

Revenue.—The revenue accounts show that the receipts of the company from all sources properly attributable to the year have been £103,000 8s. 4d., as against £92,344 15s. 9d. in the preceding year, or an increase of £10,655 12s. 7d.

Working Expenses.—The working expenses for the year have been £32,583 5s. 4d., as against £31,950 7s. 3d. for the preceding year, or an increase of £632 18s. 1d.

Depreciation, &c.—The sum of £13,825 0s. 9d. has been written off in the revenue account in respect to the renewal, maintenance and depreciation of the London exchange system, &c., including lease of premises, office furniture, stocks of instruments, &c. This, added to the amount previously written off, makes a total of £48,598 2s. 3d.

Dividend.—The balance of net revenue account is £61,653 5s. 10d., of which amount the sum of £10,951 2s. has been absorbed by the payment of an interim dividend at the rate of 5 per cent. per annum for the first half year ending 31st October, 1884, and the directors recommend a further dividend of 7s. 6d. per fully paid £5 share (part paid shares receiving in proportion) for the second half year ending 30th April, 1885, amounting to £32,853 6s., making a total dividend of 10 per cent. for the year. The directors also propose to carry £10,000 to reserve, leaving a balance of £7,848 17s. 10d.

Progress of the business is shown in the following tabular statement :—

| | Exchange subscribers. | Private lines. |
|---|---|---|
| Year ending 30th April, 1881 | 914 | 186 |
| do. do. 1882 | 1,673 | 366 |
| do. do. 1883 | 2,745 | 576 |
| do. do. 1884 | 3,350 | 715 |
| do. do. 1885 | 3,820 | 835 |

Relations with the Post Office.—Since the date of the last report the position of the company in its relation to the Post Office has been greatly modified. Experience had proved that the extension of the telephone system was seriously hampered by the limitations and restrictions imposed upon the company under the original licence granted by the Post Office.

The importance of telephonic communication as an aid to the social and commercial needs of the community had made itself felt, and public opinion had decidedly pronounced against any unnecessary obstruction to its development. Happily that lamented and distinguished statesman (Mr. Fawcett), who then filled the office of Postmaster-General, recognised the position, and with, as is believed, the entire concurrence of the officials of the department, granted a new licence, considerably enlarging the area of the company's operations in and about the Metropolis; permitting unrestricted intercommunication between the several districts of the United Kingdom served by the affiliated companies; and generally removing obstacles to that extension of telephonic business which must follow reasonable freedom of action on the part of those charged with the conduct of this important public service.

Until, however, the position of the companies in reference to wayleaves for the erection and attachment of wires, and other necessary apparatus for carrying on the work, rests upon some recognised basis, it will be impossible that the telephone system of the country can be extended as rapidly, or worked either as efficiently or economically as the growing wants of the public demand.

Company's Bill in Parliament.—A Select Committee of the House of Commons has recently held a prolonged enquiry on the subject of "Telephone and Telegraph Wires," and after hearing the evidence of many competent witnesses, representing the public bodies, the local vestries, the Post Office and the telephone companies, has issued a report fully recognising the great advantage in the public interest of granting to the Post Office and the telephone companies the necessary powers, to be exercised of course under the reasonable control of some official authority.

In order to call the attention of Parliament to the subject, the board in the present Session presented a Bill, which was, however, not proceeded with, pending the inquiry of the special committee above referred to. Awaiting the action of the authorities upon the report of that committee, the board thought it only respectful to withdraw their Bill for the present.

The report, with the evidence upon which it is founded, is now published, and the board commend its careful perusal to the proprietors, as well as to their subscribers and all others interested.

District Company.—The formation of a separate company for the metropolitan district having been suggested to the board, the notice of the meeting has been framed so as to confer the necessary powers upon them, if they should consider it desirable, to proceed with the matter upon such terms and conditions as they feel they could properly submit to the shareholders at the special meeting which it would be necessary to call for that purpose.

The Balance Sheet was as follows :—Balance Sheet, 30th April, 1885.

DR.

| | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| To Creditors ............................ | | | | 15,189 | 11 | 6 |
| To Amount received in respect of privileges conceded to the following companies, viz.— | | | | | | |
| Cash (received from the Lancashire and Cheshire Telephonic Exchange, Limited.............. | 50,000 | 0 | 0 | | | |
| 45,000 ordinary shares of £5 each fully paid, in the National Telephone Company, Limited ...... | 225,000 | 0 | 0 | | | |
| 50,000 ordinary shares of £1 each, fully paid, in the Lancashire and Cheshire Telephonic Exchange, Limited ................. | 50,000 | 0 | 0 | | | |
| 7,500 ordinary shares of £5 each, fully paid, in the Northern District Telephone Company, Limited ............................ | 37,500 | 0 | 0 | | | |
| 87,500 ordinary shares of £1 each, fully paid, in the Telephone Company of Ireland, Limited... | 87,500 | 0 | 0 | | | |
| 160,000 ordinary shares of £1 each, fully paid, in the Western Counties and South Wales Telephone Company, Limited... | 160,000 | 0 | 0 | | | |
| 93,750 ordinary shares of £1 each, fully paid, in the South of England Telephone Company, Limited ............................ | 93,750 | 0 | 0 | | | |
| Carried forward ......................... | 703,750 | 0 | 0 | 15,189 | 11 | 6 |

| | | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Brought forward | | 703,750 | 0 | 0 | 15,189 | 11 | 6 |
| *Deduct* :— | | | | | | | |
| Bonus of 10s. per share, paid on 80,000 shares, out of the cash portion of the above | £40,000 | | | | | | |
| Proportion of legal expenses | 1,350 | | | | | | |
| Proportion of management expenses | 5,400 | | | | | | |
| | | 46,750 | 0 | 0 | | | |
| | | | | | 657,000 | 0 | 0 |
| To reserve account | | | | | 66,863 | 7 | 9 |
| To revenue account year 1885-6 :— | | | | | | | |
| Proportions of subscriptions (*less* post-office royalties thereon) and rentals in respect of periods extending beyond 30th April, 1885 | | | | | 36,372 | 2 | 1 |
| To net revenue account :— | | | | | | | |
| Balance at credit thereof | | 61,653 | 5 | 10 | | | |
| Deduct interim dividend for half-year ending 31st Oct., 1884, paid 2nd December, 1884 | | 10,951 | 2 | 0 | | | |
| | | | | | 50,702 | 3 | 10 |
| | | | | | £826,127 | 5 | 2 |

CR.

| | £ | £ | s. | d. |
|---|---|---|---|---|
| By capital account— | | | | |
| Balance of that account | | 91,291 | 17 | 11 |
| By lease of Coleman Street office, and fixtures and furniture at Oxford Court, and at other offices and exchanges | | 4,214 | 8 | 8 |
| By stores on hand | | 19,949 | 18 | 7 |
| By shares in other companies, viz.:— | | | | |
| 45,000 ordinary shares of £5 each, fully paid, in the National Telephone Company, Limited | 225,000 | | | |
| 50,000 ordinary shares of £1 each, fully paid, in the Lancashire and Cheshire Telephonic Exchange, Limited | 50,000 | | | |
| 7,500 ordinary shares of £5 each, fully paid, in the Northern District Telephone Company, Limited | 37,500 | | | |
| 87,500 ordinary shares of £1 each, fully paid, in the Telephone Company of Ireland, Limited | 87,500 | | | |
| 160,000 ordinary shares of £1 each, fully paid, in the Western Counties and South Wales Telephone Company, Limited | 160,000 | | | |
| 93,750 ordinary shares of £1 each, fully paid, in the South of England Telephone Company, Limited | 93,750 | | | |
| 100 preference shares of £10 each, in the National Telephone Company, Limited | 1,000 | | | |
| | | 654,750 | 0 | 0 |
| By estimated dividends from subsidiary companies | | 3,100 | 0 | 0 |
| By debtors, including royalties | | 47,463 | 19 | 10 |
| By ditto, for subscriptions and rentals outstanding | | 3,575 | 12 | 5 |
| By Brighton trunk wire | | 446 | 10 | 0 |
| By Cash :— | | | | |
| At bankers and in hand | | 1,334 | 17 | 9 |
| | | £826,127 | 5 | 2 |

Mr. Blaikie, the secretary, having read the notice convening the meeting,

The Chairman said he hoped they would agree with him that they showed satisfactory results, and that their five years of very hard and anxious labour, and earnest attention to the company's interests, had now been attended with a fair amount of success. Last year they spent on capital account in the London system about £20,000. Revenue had increased by about £10,000, and working expenses by something like £600. They had written off the large sum of over £13,800 for depreciation of wires and plant in London and instruments in the provinces; this made, in all, between £48,000 and £49,000. They were still without exact data to enable them to conclude as to the right figures upon which to calculate the depreciation, but they had erred on the side of providing more than was necessary rather than less. They were maintaining and renewing wires every day, and this was provided for out of revenue. They proposed to increase the revenue account by a further £10,000, making it £76,000; so that, as far as the plant and system in London were concerned, they had sufficiently provided for any eventuality. They were somewhat disappointed that their progress in London and the suburbs had not been quicker. The increase they showed, however, was a net increase, and covered the withdrawals, which during the past year had been rather frequent, the majority of them being due to the hard times. For some months of the present financial year their progress had been checked by the offers of another company to connect exchange subscribers at a lower rate; while they had been unable yet to avail themselves fully of the extension of radius and improved terms offered by the Postmaster-General. Before they could fully take advantage of the good things obtained for them in Parliament and from the Postmaster-General, they had to do a great deal of work which was for the time unseen and the value of which could not be estimated till everything was complete and the result was shown by fresh subscribers. They had to construct long lines, they had to canvass large districts to obtain way-leaves, and other very arduous work. This was all now in full progress. To give them some idea of what they had done, he might say they had erected a cable to Brighton, which worked admirably; that, or the next day, Clapham and Kilburn would have call rooms attached to the central system; South Kensington had already been connected; the telegraph department of the General Post Office was connected with the central exchange, and in a few days subscribers would be able to send and receive messages direct; they also had a branch exchange at the Inventions Exhibition, where there were 34 exhibiting subscribers; they were pushing forward new routes from the city to Chiswick, Battersea, Kew, and Brentford; and a line to Sydenham would be running in a few days. This would show them that the directors were using every endeavour to push forward the business as rapidly as possible. They had every reason to hope that their relations with the Post Office would continue such as to facilitate the extension of their business. As to litigation, what they had had hitherto had been forced upon them; but he was glad to say they had proved to be in the right in every case. When they last met they were involved in litigation with the Globe Company. They felt that although the legal questions between them would in the end be decided in the favour of this company, yet that decision must be a matter of time; and, in the meantime, the Globe Company were giving them a great deal of trouble in many ways, although they knew very well the business they were doing was not being done at a profit. Therefore when the Globe Company approached them with an offer to sell their stock, and, in fact, their whole undertaking, including the patents upon which they relied, they thought it was in the interests of this company to buy them, and he thought, on the whole, they did wisely. They had promoted a Bill in Parliament as to the regulation of overhead wires, and putting overhead wires under some sort of authority which they could appeal to in case of dispute between themselves and any authorities or private persons, or people who objected to grant them facilities. They promoted this Bill to a certain extent, and then they found that the Government would not allow them to bring in the Bill on their own account, and they promised to legislate on the subject. The whole matter, as they were aware, was submitted to the House of Commons, and the Select Committee, to whom it was referred, had come to certain conclusions, which he supposed by-and-bye would become law. In the meantime, he thought a good deal of the public feeling created against overhead wires had subsided; so many people having found out from daily experience what a very valuable adjunct, both to public business and commerce, and to private comfort in their houses, the telephone had become. Then everyone who became a subscriber was most anxious to help them in obtaining way-leaves; and on the whole they were getting on as well as this very difficult question would allow. They had dropped their own Bill and relied upon the recommendations of the Select Committee of the House of Commons. At any rate, they would know to whom to apply in case of any difficulty in pursuing their business. The formation of a separate company for the metropolitan district having been suggested to the board, the notice of the meeting had been framed to confer the necessary powers upon them, if they should consider it desirable to proceed with the matter upon such terms as they felt they could properly submit to the shareholders at a special meeting. These words which appeared in the report, would, he thought, do away with any misapprehension that was caused in certain quarters about the issue of proxies. He could assure them that the issue of the proxies was entirely a clerical error, and they had no wish or intention to pledge the shareholders to any course at all in a matter so vital; they should never have thought of entering into any negotiation for selling the London business without taking the shareholders into the fullest confidence. As regarded this company, the way it came about was this. It had been thought, by themselves sometimes, and by some of the shareholders, that they did not develop as quickly as they might. (Hear, hear.) He did not object to the "hear, hear," because he very often thought so himself. But he had been at this work since the very beginning of the whole business; he happened to be the first man almost in communication with Professor Bell, as to the sale of the Bell patents, which were the beginning of their business, and he puzzled through it as well as he could with the assistance of the board, and he had seen the enormous difficulties that they had had to surmount. It was a new thing, and they had to be very careful about treading upon anybody's toes; the railways could not give them trunk lines, and the Post Office had interferred with them here and there, and so forth. Having these feelings they listened to some suggestions made to divide the business, keeping the United business in London, looking after their patents, looking after the large value which they had in the shares of the subsidiary companies, looking after infringers of their patents, and a variety of general work—they thought of keeping that under the heading of the United Telephone Company, and placing the telephone business in London and the suburbs under entirely new organisation, assisted, of course, by their own staff. Certain terms were proposed that did not seem unreasonable, and they went so far in the negotiations that certain gentlemen had promised to join the board. But when they discussed the thing with their legal advisers they found—putting aside the detail and the price they were to receive—that they would be confronted by certain paragraphs in their articles of association and agreements with subsidiary companies that might, and probably would, lead them into a sea of legal difficulties which it would be very difficult to foresee the end of. On the whole, they thought they were not quite right to bring before the meeting a scheme which they could not entirely recommend to their approval. They were also guided somewhat by certain words that were said to him (the chairman) and other of his colleagues, and letters which he received, asking them to bear in mind that now they had overcome so many difficulties, with the public, the authorities, and the Post Office, and that they were landed, as shown by their report, in a position of considerable comparative comfort and prosperity—that now the great difficulties that had to be overcome in the initiation of this great enterprise had been overcome successfully, and if there was any good to be got out of a new organisation and new business, why should not they do it themselves? (Hear, hear.) That also appealed to their feelings, and before they approached the shareholders with any definite proposition, they thought they would realise for themselves exactly what difficulties and responsibilities they would incur, and possibly sketch out some scheme which, while organising the business in another way, would enable them to realise those hopes that were entertained, and so retain that profit which necessarily they would have to part with in selling to another company. He did not think, however, that they had quite made up their minds that it would be unwise to sell, even to a separate company, seeing the character of the people who were going to undertake the work for them. But if they pursued the matter further they would summon a special meeting, and tell them all about it. He concluded by moving the adoption of the report and accounts, and the declaration of a dividend of 7s. 6d. per £5 share, free of income tax.

Mr. J. Staats Forbes seconded.

Mr. Leyland supported the motion, but commented on the delay in sending the report to the shareholders. He also spoke in favour of retaining the whole of the business in their own hands, and concluded by enquiring as to the percentage on the profits which the directors were entitled to after paying a dividend of 10 per cent. Nothing appeared upon the balance sheet, but he thought it was an eminently wise plan to pay directors by results.

Mr. E. H. Galsworthy suggested the closing of the accounts in June and December rather than in May and November, as the present course was inconvenient. He would like to know the principle upon which the depreciation was calculated, and whether the company would present another Bill to Parliament. He also suggested, if a new company were formed, that the whole of the interest should be offered to the shareholders of this company.

Mr. Sichel pointed out that if this latter plan were adopted they would not be able to get a quotation on the Stock Exchange.

The Chairman, replying to the remarks made, said in consequence of the almost unanimous expressions of the shareholders, the board would drop the idea of the Metropolitan Company. But they had it in their minds to carry out some division of the present business on the lines he had previously indicated. He agreed that the report and accounts should be issued a longer time before the meeting, and he would take care that in future they should be sent out at least seven days beforehand. They were quite aware that some of the patents only had six years to run, and they hoped to have so fully occupied the ground by that time that the dropping of the patent would not be a very serious matter. In accordance with a suggestion, too, they would in future reports give some information as to the position of the various subsidiary companies in which they were interested. With regard to depreciation, they took a varying percentage of from 15 to 20; but there was no reliable data in existence yet. He did not know that they would introduce another Bill in Parliament; they would rather wait and see what Parliament intended to do. With regard to the directors' remuneration, although they were entitled to 20 per cent. on the profits of the year, £12,787, and felt that they had earned it, they had not taken it, as they preferred to leave it to the shareholders. He then put the motion for the adoption of the report, which was carried unanimously.

Mr. Leyland moved, "That the directors do charge the sum in the accounts to which they are entitled under Article 58."

Mr. Galsworthy seconded this motion, which was also carried, one shareholder only dissenting.

Mr. Batten was re-elected a director, and the auditors, Messrs. Quilter, Ball & Co. and Messrs. Price, Waterhouse & Co. were reappointed, after which a vote of thanks was accorded the board, and the meeting terminated.

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## West Coast of America Telegraph Company, Limited.

Mr. ROBINSON KENDAL, on Wednesday, presided over the eighth ordinary general meeting of this company, which was held at the Cannon Street Hotel, and was attended by four shareholders.

The report submitted and adopted was published in the REVIEW last week.

Mr. Fred. L. Robinson, the secretary, having read the notice convening the meeting, and the minutes of the previous meeting, The Chairman said had he followed the peremptory orders of his doctor he would not have been present, but duty and inclination alike led him to come. He had now the pleasure to move the adoption of the balance-sheet and report, which showed the gross revenue to be £52,011 10s. 7d., against the sum of £57,338 12s. 1d. for the previous year, leaving a nett balance of profit, after paying debenture interest and all other charges, of £14,523 15s. 6d., a result which, all things considered, was as satisfactory as could have been looked for, and which had enabled the directors to commence the regular payment of dividends to the shareholders, and to place the company, by the creation of the reserve fund, in a much stronger and more healthy financial condition. Up to this time dividends on the ordinary shares had been paid as soon as the finances admitted of their payment, but the board thought the time had come to equalise the dividends, as far as practicable, and to make them payable half-yearly. A sum of £12,000 was distributed in dividends in January last year, and a further sum of £6,000 was also distributed in July; £10,000 had been placed to reserve, and a balance was left of £3,349. Out of this the board recommended that a final dividend of 2s. per share be declared, with a further interim dividend of 2s. per share, making in all a dividend of 4s. per share, or a total sum to be distributed of £6,000. This, though not so satisfactory as might have been wished, was yet far from unsatisfactory, considering the drawbacks and difficulties the company had had to struggle against in the shape of a deplorable and disastrous war and great depression of trade. The latest advices from the West Coast represented trade as being now at its worst, and said any change which might take place must be for the better. Notwithstanding the severe depression and the universal complaint of the badness of the times, their company had nothing to complain of so far this year, but had something to hope for in the not impossible event of a restoration of peace and revival of trade along the entire coast. The chairman concluded by moving the adoption of the report.

Mr. T. Fielden Campbell, a director, seconded, and the motion was carried.

The remaining business, the re-election of the retiring directors, Messrs. MacAndrew and Campbell, and of the auditor, Mr. Weise, was quickly disposed of, and the meeting terminated with a vote of thanks to the chairman and directors.

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## Dundee and District Telephonic Company, Limited.

AN extraordinary meeting of the shareholders of the Dundee and District Telephonic Company, Limited, for the purpose of considering special resolutions for the transference of the property of the company to the National Telephone Company, in conformity with a provisional agreement come to between the directors of the two companies, and the winding-up of the local company, was held in Lamb's Hotel, Dundee, on Tuesday afternoon, Mr. Peter Matthew, in the absence of ex-Provost Moncur the chairman of the company, presiding.

Mr. A. W. Cumming, solicitor, having read the notice calling the meeting, and the resolutions to be submitted, laid before the shareholders the provisional agreement, which set forth that the estate of the Dundee and District Company was to be made over to the National Company as at the 30th June, the latter company relieving the Dundee Company after that date of their agreements with the Post Office, and of all liability as to their premises; the National Company to pay the Dundee and District Company £8,500 in cash as at that date, with 5 per cent. interest until paid; the Dundee Company to be wound-up in terms of the Companies' Acts and the agreement, the costs being equally divided; and any differences between the two companies to be settled by Mr. J. B. Balfour (the present Lord Advocate), whom failing, Mr. W. Mackintosh, advocate. Mr. Cumming next read a letter from Mr. Patey, the Secretary of the Post Office, giving the consent of that department to the agreement.

The Chairman read a letter from ex-Provost Moncur, showing that the chairman of the company was thoroughly in harmony with the object of this meeting.

He then moved the following resolutions : –

1. That the agreement or provisional agreement made by and between the Company on the one part and the National Telephone Company, Limited, on the other part, of dates the 12th and 13th June, 1885, for the transference of the estates, rights, assets, and effects, as also to the said the National Telephone Company, Limited, on the terms and subject to the conditions expressed in the said agreement or provisional agreement, be approved of, and the company hereby specially resolve to sanction, and hereby specially approve of and adopt the same.

2. That the company, viz., the Dundee and District Telephonic Company, Limited, be, and the company hereby specially resolve and require that it shall be wound-up voluntarily, under and in virtue of the powers and provisions applicable to the voluntary winding-up of companies, contained in "The Companies Act, 1862," and all amendments and extensions thereof, including the powers and provisions conferred by section 161 of the said Companies Act, 1862, but in consistency always with the terms of the said agreement or provisional agreement; and with power and authority to the liquidator or liquidators to be appointed to conduct said winding up, to enter into and to conform to and implement and carry out the said agreement or provisional agreement, with any alterations thereon or additions thereto proper or necessary.

He said:—Before asking you to adopt these resolutions you have a right to some explanation from your directors as to why they for a second time in the history of this company have entered into a provisional agreement for its transfer by sale to the National Telephone Company. Most of you will remember the circumstances under which the shareholders were convened in December, 1881, and asked by the then directors to confirm the provisional sale made by them and the result of that meeting, viz., that the shareholders declined even to entertain the proposal until the directors had submitted the accounts of the company for the previous 16 months. We met again on the 1st February, 1882, when a report and accounts were submitted showing a most satisfactory state of affairs, and confirming the payment of a dividend and bonus equal to 21 per cent. per annum on the paid up capital. We were then informed that the National Telephone Company had withdrawn their offer made two months before, but there was a general feeling of satisfaction that the business had not been sold, and it was resolved to persevere energetically in extending the business of the company as heretofore. At that date this company had 200 wires, and the National had 47. The majority of the present directors were then elected, and have continued in office till now. During the following year (1882) a keen competition was carried on, and the National, evidently under a revengeful feeling and a determination to crush us if possible, lowered their rates to £5, and gave numerous leases thereat for a period of years. Not to be beaten, we also lowered our rate to £5 10s., and the result of the competition and low rates increased the business of both companies, so that at the end of the year our 200 had increased to 270 wires, and the National Company had added 195 to their 47, making 242 wires. You know our accounts submitted 7th February, 1883, despite of the diminished revenue from the low rates, showed a very satisfactory profit, but the whole of it, and a call of 10s. per share besides, was required for our extended business, so that we declared no dividend for 1882, prefering to create a reserve fund and carry forward the balance till further experience had shown the full results of the low rates. The report and accounts submitted to you on 6th February, 1884, showing a steady available profit, we divided 10 per cent. for the two years 1882 and 1883, making 5 per cent. for each, besides adding £200 to the reserve fund, which then stood at £600. At the end of 1883 this company had 320 wires in use, being an addition of 50 for the year, whilst the National Company had 491, being an addition of 249. I come now to our last balance sheet, submitted on 4th February, 1885. It showed an available profit of £633, which allowed a dividend of 5 per cent. for the year, and £200 put to the reserve fund, making the reserve fund amount to £800, against an expenditure in plant of £7,434, on which we had never allowed any abatement for wear and tear. The end of 1884 showed we had 340 wires in use, being an addition of 20 for the year; whilst the National Company had 663 in use, an addition of 172 for same time. On 31st May last this company had 348 wires, being an addition of eight for the five months; whilst the National had 723, an addition of 60 for same time. This company up till now has been a most successful one; but you must see that the keen competition going on for the last three years has involved pretty active work, and considerable personal influence on the part of our manager and the directors in order to maintain our position and show the results achieved in your balance sheets. We have also to thank those who have supported us throughout, and were proof against all attempts made to remove that support. The conviction, however, has been growing in the minds of the directors that, with the inducements offered to the public by the National Company, our company could not expect to hold its own much longer. These inducements are:—1. More than double the number of our subscribers. 2. Their list includes a large number of professional men, doctors, retail tradesmen, and others. 3. They give communication with Broughty Ferry, Newport, Tayport, Forfar, Arbroath, and Perth, and are gradually adding other places. 4. They give unceasing service at all hours of the day and night on week day and Sunday all the year round. 5. Their instruments are by common consent very much handsomer than ours, being artistic pieces of furniture which would grace any room. Our convictions were considerably strengthened last year when we required more capital and asked the shareholders to take 500 shares in order to keep on the fight. Only 372 shares were taken up by exactly half the number of shareholders, and of these 372 shares, 155 were taken by the directors themselves. Our bank account had to be overdrawn, and for this the directors had to give their personal guarantee. It has been asked why didn't we go to the districts round about and occupy the ground? We must tell you frankly we had neither the money nor the instruments; but, could we have got an unlimited supply of instruments, I dare say we might have got the money. The want of telephones is our chief weakness, and it is a fatal one. When, therefore, in May last, we were informed that the National might buy our business and plant, and as the result of private conferences between the chairman and resident director of the National and ourselves, we actually got the offer of £8,500 for same payable in cash, we felt it to be our duty, in the interests of our shareholders, to secure this offer by signing the provisional agreement now read to you, and submit it, as we now do, for your consideration, and, we trust, your unanimous approval. It may be as well that I should let you know the probable results to yourselves from accepting this offer. Of course, the figures cannot be strictly accurate, but they are a very likely estimate. You have got to end of 1884 about 9 per cent. per annum of dividend for the 4¼ years to that date, and if you confirm this transaction to-day—after dealing liberally with our manager, electrician, employés, and directors—we expect to return you your capital and about 40 per cent. bonus in addition, which all must acknowledge to be a very satisfactory result. But it remains for me to say a few words on the relations this company sustains to the public. It was started to oppose the other telephone company, who were giving their instruments for £20 a year, and no prospect of abatement. To the practical genius of our townsman, Mr. Lowden, and the commercial genius of our manager, Mr. Simpson, we were indebted for the origin of this company, which undertook to give all the telephonic facilities required for £10 a year instead of £20, and to-day you see how they have accomplished their object. The £5 rate even to this company must be looked at as a losing game, because the contingent value of our plant is not met to anything like the extent it should be by the reserve fund created, and in a few years you might awake some fine morning to find a large amount of your capital vanished in depreciated value. £10 was the rate aimed at, and with the greater service rendered by the National Company (which your directors have the written obligation of the chairman of that company to give to all subscribers in Dundee for a £10 maximum rate if this agreement be confirmed by you to-day), we think the Dundee and District Telephonic Company has nobly done its work, served its purpose, and its shareholders have their reward.

Mr. James Murison, who seconded the resolution, said he did not think there was room in Dundee for two telephone companies to work to advantage, and that he thought it would be to the public good to have the telephonic communication given by one company. (Hear, hear.)

The resolutions were unanimously agreed to.

Mr. J. W. Shepherd moved the third resolution, which was to the effect that Mr. Alexander Simpson, the general manager and secretary of the company, be appointed liquidator of the company, and that the directors be appointed to act along with him as a committee of council, and to fix the amount of his remuneration.

Mr. W. A. Douglas seconded the resolution, which was also unanimously agreed to.

On the motion of Mr. Jas. Stevenson, seconded by Mr. Andrew Taylor, the sum of £250 was awarded to the directors for their services last year, and up to the date of the completion of the winding up of the company.

The Chairman then stated the amount of the remuneration that the directors proposed to pay to Mr. Simpson, Mr. Lowson, and the other *employés* of the company, and said that all connected with them must be heartily pleased, as he hoped the shareholders also were, and the company would be wound up with *eclat*, a thing very uncommon in these days.

On the motion of Mr. R. G. Kennedy, a vote of thanks was awarded to Mr. Matthew for presiding, and also for his services in connection with the transfer, and the proceedings then terminated.

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**Compagnie Française du Télégraphe de Paris à New York.**—According to the accounts for the year ended 31st December, 1884, the net available balance, including 217,705 francs brought forward, was 1,967,326 francs, after deducting 223,680 francs for amortisation. Of this, 840,000 francs was distributed as an interim dividend of 10 francs per share. A final dividend of 5 francs per share will be paid on the 15th of July, amounting to 420,000 francs, a balance of 707,326 francs being carried forward. The total receipts for the year amounted to 2,820,212 francs, and the general charges to 846,912 francs.

**Indo-European Telegraph Company, Limited.**—This company is prepared to receive, at its chief office, 18, Old Broad Street, E.C., on and after the 1st of July, applications for the fourth series of coupons to be issued to holders and share warrants to bearer in this country.

**Consolidated Telephone Construction and Maintenance Company, Limited.**—The shares of this company, it is notified by the Stock Exchange Committee, are to be quoted as of a nominal value of 15s. instead of £1.

**Great Northern Telegraph Company, Limited.**—The half yearly interim dividend on the shares of this company, at the rate of 5 per cent. per annum, will be paid on the 1st July by Messrs. C. I. Hambro & Son, 70, Old Broad Street, E.C.

**India Rubber, Gutta Percha, and Telegraph Works Company, Limited.**—A quotation has been ordered by the Stock Exchange Committee of the new shares of this company.

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## LEGAL.

**The Queen v. Her Majesty's Postmaster-General**—(Queen's Bench Division).—On Thursday, last week, Mr. Justice Mathew delivered the judgment of the Divisional Court before whom this case was argued. It came before their lordships on the argument of a rule obtained by the Great Western Railway Company calling on her Majesty's Postmaster-General to show cause why a *mandamus* should not issue commanding him to appoint an arbitrator under the Railways Arbitration Act in order to determine what amount should be paid to the company in respect to telegraphs along their line. The line in question was the Llynvi and Ogmore line, which had become merged in the Great Western Railway's system, and the whole question turned on the construction of an agreement entered into in accordance with the provisions of the Act of 1868, under which the Postmaster-General was to have the absolute control of telegraphs on all the railway lines in the kingdom. In respect to this particular line the company sent in a claim for compensation amounting to £40,000, and this was resisted by the Postmaster-General. Mr. Justice Mathew now said that in the opinion of the court the Great Western Railway Company were wrong in their contention, and the rule for the *mandamus* would be discharged.

**Hammond Electric Light and Power Supply Company, Limited**—(Before Mr. Justice Kay, Saturday).—This was an application for a winding-up order, presented by Mr. R. Hammond, the founder of the company, creditor for £750. The company was established in 1882, for the purpose of purchasing and carrying on the business of the petitioner. Its nominal capital was £330,000. The vendor had various contracts, and his business included licenses and concessions for the lighting of the Prince of Wales's Theatre, Birmingham, the Grand Theatre at Islington, the Royal Aquarium, and other places at Brighton and Hastings. On the 10th inst., the court appointed Mr. William Theobald provisional liquidator, with power to continue existing contracts. Since the petition was presented a meeting of the shareholders, pursuant to notice, was held, and it was resolved that the company should be wound-up voluntarily, as it found it could not continue to carry on its business. Several of the shareholders were parties to this application. Mr. Robinson, Q.C., appeared in support of the petition. Mr. Northmore Laurance, who appeared for the company, offered no opposition. His lordship granted an order for the winding-up of the company under the supervision of the court.

## CORRESPONDENCE.

### Secondary Batteries.

The fact that the Miller Prize has been awarded by the Council of the Institution of Civil Engineers to Mr. F. G. Howard for his paper on Secondary Batteries, attaches to that communication a certain importance. Students will regard it as the latest information on the subject; but it appears that the author is not well acquainted with the latest forms of secondary batteries, nor with their recent applications. I do not wish to depreciate the value of the paper, which in many points is exceedingly interesting and instructive, but I wonder why Mr. Howard finished off with a period (the Vienna Exhibition of 1883) when secondary batteries, and especially their applications, were so little understood.

It behoves those who have gained experience with these appliances since Mr. Howard relinquished the task of making notes on the progress of certain types of cells, to supplement the information supplied at the Students' Meeting of the Institution a few months ago; there are, moreover, several statements which require modification or explanation. Taking them in consecutive order, we find first a table giving the "storage capacity of various secondary batteries as regards ratio of work to weight," and there stands a "theoretically perfect" cell with a storage capacity of 360,000 foot-pounds, with the highest percentage of efficiency = 100.

We know that the energy evolved by the oxidation of a pound of lead is equivalent to 360,000 foot-pounds, but we cannot conceive an ideal *battery*, where, even if every atom be active, that amount of work could be put in. The comparison of efficiency thus established is not a happy one, and it is misleading. The batteries referred to in that table are all made of lead, and if the comparison or "efficiency" refers to a peculiar arrangement of the materials, the "theoretically perfect" cell should be left out, and instead of "efficiency," call it relative capacity, or establish a coefficient, if such were deemed useful.

Mr. Howard states, and others have said, that "the advantages of accumulators made after the Plante type over those of the Faure type are that they afford a far higher rate of discharge. This property is invaluable for many purposes, as, for instance, where numerous lamps are required to be run for only a short time." By Faure type, I presume is meant a battery with lead oxides. It would be exceedingly interesting to know whether the two types referred to have ever been discharged side by side, say supplying 100 lamps for half-an-hour; two batteries of equal weight discharging at the same rate.

As regards the durability of the Sellon-Volckmar type, and the effect of over-charging, the author seems ill-informed. At any rate, the batteries made by the Storage Company within the last twelve months have given great satisfaction, of which fact anyone could satisfy himself with very little trouble. With properly constructed batteries this overcharging is not such a serious matter as is generally supposed.

Why should the Planté accumulator arrive at its "maximum efficiency" when "it is on the point of falling to pieces?" The Planté plate has its highest *storage capacity* when it gets thoroughly disintegrated; but surely the *efficiency* has nothing to do with the period of existence.

Mr. Howard advises his audience to test the cells from time to time "by taking a short length of stout wire, holding one end upon one pole of the cell to be tested, and striking the opposite pole with the other end of the wire." This is an old-fashioned, clumsy, and to novices, dangerous method. The proper way is to use a low constant voltmeter or a detector, and observe the deflection of the needle upon a scale, taking one cell at a time, thereby one can see not only whether the cell is *quite* discharged, but also whether the E.M.F. is low; and further, whether a reversal has taken place in any one cell, in which case the needle will deflect the "wrong" way, relatively to the terminals of the plates.

With regard to the employment of secondary batteries for tramcars and boats, I may state that there has been more real, practical work done *since* 1883, where Mr. Howard leaves off, than at any previous time.

The *Electricity*, which was launched in 1882, has been altered in the spring, 1883, by taking the countershaft out and running the screw direct from the armature of the motor. This was considered impracticable by marine engineers, and Messrs. Yarrow & Co. could only be convinced of the efficiency of the working of a high speed propeller after I had completed a series of experiments, when they adopted the same plan in the Vienna launch. This I mention because Messrs. Yarrow and Company receive, generally, the credit for the innovation. The electric launch *Australia* has been in successful operation since last summer, and her cells, which have had a fair amount of work to do, have not cost their owners one penny for repairs; they are still in perfect order, as well as the motor. Whereas the motor in the launch *Electricity* weighed 658 lbs., and took 46 ampères with 90 volts, the motor of the *Australia* (a slightly larger boat) weighs 390 lbs., and absorbs 36 ampères, with 100 volts, at the same rate of speed afloat. Electric launches of different sizes are now in course of construction.

Great activity has been shown in the development of electric tramcars during the last year. The car which has been described in your journal in December last, has had severe tests since the beginning of October, partly on that stiff line at Millwall and partly at Battersea. The difference between this car and the one mentioned by Mr. Howard is very great. The new accumulators weigh and measure just one half of the former, the motor also absorbs one half the current for the same speed of car.

The tramcar cells contain 26 lbs. (each) of lead plates, they are charged at the rate of 32 ampères, and discharged at an average rate of 46 ampères; mounting stiff inclines they give 100 to 150 ampères; on the level, 30 to 35 ampères with loaded car. These cells have been working for eight months and they are still in splendid condition; it would do Mr. Howard good to see them. When the car is not running the cells are kept at work for other purposes in order to ascertain their durability.

Another tramcar of exactly similar design to this last one has just been shipped to Cologne, and there are signs which encourage the idea that electric propulsion by means of secondary batteries will receive a practical development on the Continents of Europe and America before certain prejudices and red-tapeism in this country will be overcome.

If Mr. Howard choses to read another paper on the same subject he will find ample new material, and I am sure he will receive plenty of information for the mere asking for it, and he will be invited to make his own observations if it is for the purpose of instructing those who still look upon secondary batteries as laboratory toys.

**A. Reckenzaun.**

*June 20th*, 1885.

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I fear that many outsiders reading Mr. Geere Howard's paper upon Secondary Batteries, will jump too readily at the conclusion that they are "almost hopeless," an impression which, I am quite sure, the author had no intention of conveying, being himself, I venture to think, a full believer in them. He has not, it is true, called in question their convenience, their economy, and as is the case under very many conditions their indispensability, but the conclusion which might be deduced from his statement as to their durability, overrides all these considerations, and if not modified might to some extent stand in the way of their general employment.

In Mr. Howard's experience, one of two things must have occurred; either the batteries upon which he bases his statement were very badly made, or they were very badly used. In either case, the period of their life may have been as readily but a few weeks or even days, as the few months he accords to them.

Unfortunately, there is no doubt that many of the batteries constructed at a certain period by the chief manufacturing company—as also by other persons—were seriously defective in one or more points—imperfect formation, bad connections, unsound containers, disproportion to the work for which they were to be applied, were faults consequent upon carelessness and inexperience, and all these elements have played their part in bringing about untoward results; but such mishaps, however occasioned, have no real bearing upon their practical usefulness or otherwise, and it would be not only unjust to those interested, but unfortunate as regards scientific and industrial progress, if preventable causes are taken into account in considering the abstract principles of utility and success.

I should have been delighted had Mr. Howard favoured me with a few enquiries before dealing so summarily with a subject of vast scientific and commercial importance, and I could, I venture to think, have resolved many doubts he appears to entertain, and have convinced him that sufficient time has not as yet elapsed since the employment of the forms of secondary batteries to which he alludes, to arrive at any accurate data for estimating their length of life.

So far as the forms in which I am interested are concerned, no failure has come under my notice which has not, on investigation, been satisfactorily accounted for. I say satisfactorily, in the sense of having been proved to have arisen from remediable causes entirely unconnected with the principle involved. I can show Mr. Howard cells which, with the exception of occasional intervals of a few weeks, have been in full and regular work since they were first manufactured under my specification before any commercial development took place, viz., the spring of 1882, a period of three full years, and their present still perfect condition warrants the assumption that they will do duty for as many years more. *Care in manufacture and ordinary attention to rules for working, are all that is essential to make this a normal condition*, and the evils of buckling, of undue sulphating, of short-circuiting, and of local action (the latter causing the separation of the active material from the conducting frame or support) need *never* occur, and should now be things of the past.

I will not at present further encroach upon your space to touch upon some points in Mr. Howard's paper which are open to remark, such as his suggested mode of testing, &c., but I would wish to remove the impression he conveys that "skilled" supervision is necessary. Intending installers of the electric light might be unduly influenced against its adoption if they supposed that they must keep an electrician on their premises. My experience over some years is, that once installed on right principles and under competent supervision, there is nothing in the working of the electric light, either in respect of the engine, the dynamo, or the accumulators, which is beyond the capacity of an under-gardener or labourer of average intelligence after a few days' training.

The work and anxiety to those engaged, whether as amateurs or commercially, in pressing forward the introduction of electric light, has indeed been an uphill one, and now that the initiatory labour is, it may be hoped, drawing to a successful issue, and the practical and beneficial result within measurable distance, it would be disheartening if any purely imaginary difficulties are raised as bugbears, which cannot fail to retard its development.

With regard to the immense employment which is in prospect for electrical accumulators my views have been pretty generally known, and as time passes they are, I am happy to say, being slowly but surely justified and confirmed; already most of my friends, some of them distinguished electricians, who in the early days good naturedly laughed at my enthusiasm and confidence in their ultimate success, freely recognise and admit their necessity, and the important part which they are destined to play in the great commercial industries now rapidly growing out of the utilisation of electricity.

**John S. Sellon.**

The Hall, Sydenham, *June 24th*, 1885.

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We notice your article in last week's paper respecting "secondary batteries," and are much pleased to be able to give you positive testimony concerning their work, which you ask for.

We have (beyond many sales effected) in use at our Queen Victoria Street Depôt an installation of secondary batteries, made by the Electric Power Storage Company, consisting of 30 1½-H.P. cells, which have been in constant use for eleven months. They have been worked daily, not only for lighting our depôt and office, but for driving motors, charging small accumulators, and many other purposes. We are pleased to testify that up to the present moment we have not had the least trouble with them, or changed a single plate, and beyond filling with water to replace the loss caused by evaporation, we have had no cause to give them the slightest attention. The cells are now apparently as good and useful as when first put in.

We shall be happy to show them and give information to any of your readers who care to pay us a visit.

**The Electric Apparatus Company, Limited.**

60, Queen Victoria Street,
London, *June 24th*.

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I have read in your last issue the paper on this subject by Mr. F. Geere Howard.

His paper, throughout, bears unmistakable signs of having been compiled long since; and it is only from the fear that it may be taken as in any way referring to batteries as now manufactured that I hasten to draw attention to the practical and commercial points raised by him.

The first question of any interest is a table showing what he terms the *efficiency* of different types of cells, which, to begin with, is likely to be misleading, as this word is universally employed for the relation between the amount put into a cell, and that taken out; whereas he applies it only to chemical equivalents, which merely affects the weight of lead required for a given output. The important question of *efficiency*, in the acknowledged sense of the word, is not mentioned.

As regards his remarks on the Planté type of battery, I may mention that I have lately carried out a number of experiments with plates of this class, with a view to using them as regulators, if the results justified their adoption. One of these was made with some of the lead grids, cast solid in the centre, which are used for manufacturing and experimental purposes at the works. These had been charged off and on for considerably over a year, and had received over 3,000 ampère hours per plate, which is more current than the patience of an average customer would be likely to bestow on them before he expected a fair capacity. The cells were first made up with both positive and negative of the above plates, and it was found that the capacity, which was ridiculously small, increased for two or three charges and then began to fall off. Next they were reversed, when the capacity rose slightly, but soon fell off again, due evidently to the scaling off of the active material as soon as it attained a certain thickness. Then pasted negatives were used with lead positives, and *vice versâ*, when the results were slightly better, but still too insignificant to render the cells worth further consideration. Next the efficiency and E.M.F. were tested at rapid discharges, but here again they fell altogether short of the pasted plates. Some cells of the recognised Planté type, and the latest pattern, were then obtained, and so far the tests have been no better, but as I hope later to send you these in a more complete form, I will abstain now from giving the actual figures.

Mr. Howard's remark that the Faure or pasted type of cells will not discharge at a rapid rate can hardly be based on experiment. We have discharged cells containing 13 plates, weighing 1 lb. each, at a rate of 100 ampères for 20 minutes, in connection wih torpedo propulsion. This treatment, although it is not in any way recommended for regular work, shows that if called upon to give a large current the cells will do it.

Mr. Howard then gives his ideas as to the working of secondary batteries, which are more than sufficient to explain the deplorably short life he allows them; and I sincerely hope his paper may not fall into the hands of any of the present users of our cells. First he flashes the cells with a stout copper cable, which is certainly the quickest way of spoiling a battery. Then he runs off the liquid and leaves the plates to oxidise in the air, or fills them up with water, which has been proved to loosen the paste and cause it both to fall out and scale when the cells are again put in use.

He further states that an overcharged cell will be destroyed in a few days; but we have charged boxes, each containing six positives, for over two months without any discharge, and at the end of this time, during which the plates received over 6,000 ampère-hours, not only was their working all that could be desired, but the plates showed no signs whatever either of buckling or scaling, and the grids were quite sound. Such cells have since been in successful use for many months for continuous lighting.

We are told that if from too rapid charging the cells become warm they must be left to cool. This would equally apply to a copper conductor which had become warm from an unusual number of lamps being in use. But I question whether the user would care to sit in the dark while his cable was cooling, in order to avoid the extra loss involved. We have made several experiments in connection with tramcar work to determine how many sets would have to be provided for each car in regular work; a point which had to be settled much in the same way as the size of a conductor, which has been so ably handled by Professor Forbes, except that in this case it was a question of balancing interest and depreciation on cells against loss in efficiency by too rapid charging. The cells were frequently made hot in these tests, but no signs of buckling are to be seen in any of them at the present moment.

"*If placed on a damp floor the cells will rapidly run down.*" This is quite overcome by the use of glass boxes properly arranged in permanent installations.

"*The author contends that secondary batteries always will require skilled labour.*" I can refer him to a number of installations where there is no skilled labour, and the cells are giving every satisfaction.

"*If left idle and full of solution sulphate will form all over the plates.*" We have left cells fully charged for months together without drop in specific gravity, or formation of sulphate.

"*The most economical way is to charge each battery in two series in parallel.*" This introduces an unnecessary liability to charge one half of the cells more than the other, and the economy effected is not very apparent.

Finally, with regard to the vital question of life of the plates, I would refer Mr. Howard to the advertisement columns in this issue, with the remark that there are over 40,000 of our plates which have already been in use longer than the time he mentions, and show no signs of depreciation whatever, and certainly, as far as I am able to judge, the present types of plates will last years not months.

Apologising for the length of this letter.

**Bernard Drake,**
*Managing Engineer,*
*Electrical Power Storage Company.*

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Mr. Geere Howard's experience as to the short life of secondary batteries is scarcely to be wondered at. To constantly test them as he recommends, by taking "a short length of wire holding one end upon one pole of the cell, and striking the opposite pole with the other end of the wire," thus producing at every spark a short circuit, would be about on a par with driving an iron spike into the coils of a dynamo to examine its insulation. If under such treatment cells last six months their natural life may be safely considered as many times that number of years. Surely any one attempting to guide the public on the subject of secondary batteries should first know how to use them.

**Nemo.**

22*nd June*, 1885.

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In your issue of the 20th, you say, "We should be pleased to know how many of our readers can point to installations in which secondary batteries have been in successful operation for, say at least, a year." If you have a space to spare, I will give you my experience of an E.P.S. accumulator. To keep them in order you want a practical man on the installation, testing and keeping them clean, or they will soon go wrong. As to using any kind of instrument to tell you when the box is charged by the acid, it is a mistake, for Mr. Sellon must know, by the battery that was packed and called the works battery, the acid was the same in number 1 cell as number 60, but after the battery had been worked a few weeks, the acid was stronger one end of the battery than the other. To remedy this we had to put in water one end and acid the other.

I do not know if Mr. F. G. Howard is the same gentleman who was with the E.P.S. Co., but he must know by this time that the accumulators are not perfection, and he will not get out of them the work supposed, for the Storage Company hardly know what the cells will do yet.

On the 20th December, 1883, they send out 55 boxes, with 59 plates in each cell, which they call 5-H.P. charging capacity 2,000 ampères; on the 5th November, 1884, the same boxes are called 4-H.P. cells, charging capacity 1,600 ampères; the same class of boxes are sent out on the 8th June, 1885, and called 3-H.P. cells, charging capacity 1,200 ampères; if the latter is correct and you charge them at a 5-H.P. rate they will be over charged, but if they are 4 or 5-H.P. cells, and they are charged as 3-H.P., they will not get charged enough.

I find they are a first-class regulator, and are very useful in case of a break down (for a few hours), but to charge them and run away with the idea that you will get such a return as supposed is a great mistake.

**H. Albert.**

Plaistow, 22*nd June*, 1885.

### Three-wire v. Two-wire Systems.

In Mr. Menges' communication to *Engineering*, he errs in stating that it is necessary with the three-wire system to have both dynamos running during the day-time when little current is wanted, thus acting as a set-off against any saving in mains over the two-wire system. It seems to me that it would be as easy with the three-wire plan as the two, to use one dynamo when the demands were light; of course it is impracticable to double the E.M.F. of the machine, which would not suit the demands if it were practicable, but by joining the two outside wires together for a common wire and allowing the middle wire for return, the only difference from the two-wire system would be the reversal of the direction of the current in one of the branches, but this would not be likely to produce inconvenience unless the working of the apparatus depended on the direction of current, and this incandescence lamps and motors do not.

In this matter the three-wire system is on equal terms with the ordinary method, so that in the case of a breakdown of one dynamo, the other may, by increasing its current output, make up for the deficiency, as in the two-wire system. Of course, the mains in the two-wire system, when thus coupled up, will have more resistance than mains constructed for an equal number of lamps on the parallel method, but that is not worth considering, for the failure of one of the dynamos should not be of frequent occurrence in a well planned station, and during the daytime when coupled up as a two-wire system, the mains would not be carrying more current than when coupled-up as a three-wire at night-time. I think the three-wire system is a decided advance over the two-wire method for incandescence lighting, and when coupled-up as a two-wire system, when little current is wanted, has the advantages of that system. For arc lighting its advantages are not so evident. The production, however, of 16-C.P. lamps, to work with 200 volts, would not necessitate the use of a three-wire system, and it is surprising so little has been done in this direction among lamp makers, seeing a prominent authority is reported to have said they were only waiting on the demand to produce such high resistance lamps. I should think the production of such lamps, to prove they can be made, would do much to strengthen the prospects of central station lighting, next to the invention of a *satisfactory* plan of station lighting from accumulators.

**James Gibson.**

Edinburgh, 22*nd June*, 1885.

### Jolin's Electric Bells.

In further answer to your correspondents, we beg to say that the short circuiting device has been used by our Mr. Jolin for series working of electro-magnets generally for some years, but was abandoned for the far more satisfactory double wound electro-magnet, owing to the sparking where currents of considerable ampère power were used, totally destroying the contacts in a few hours; with the present arrangement the coils may be of any suitable resistance, according to the requirements of the circuit. The remark of the writer of the article in the REVIEW of the 30th ult. that the working of "ordinary" trembling bells had been impractical, is, we think, amply borne out by the very fact that your correspondents, one and all, state that alterations have to be made before the ordinary bells will work in series.

With reference to the battery power required, it seems to us self-evident that bells worked by a single interrupter always offer the same resistance, but by the new arrangement the resistance of a bell is greatly reduced when striking the gong, and as all the bells are independent of one another, they offer less resistance and take less cells.

We beg leave further to say that the statement that the resistance of the coils of the bells reduces the sparking is not borne out by facts with bells arranged as your correspondents suggest; the spark at the interrupter of the master bell increases very decidedly with the number of bells worked and the necessary increase of cells in the battery. If your correspondent's view was correct, an induction coil having 10,000 turns of wire should give no greater spark than one having but one turn of wire, for the resistance of the 10,000 turns are in this case also "added up" together as well as the electromotive forces. Your correspondent probably is not aware of this point.

If any of your correspondents still doubt this, we should recommend them to try the experiment, and they cannot fail to be convinced of the truth of our statement.

**P. Jolin & Co.**

[With the insertion of this letter the correspondence on trembling bells must be brought to a close.—EDS. ELEC. REV.].

### The "New" Telephone.

I have before me Mr. Barnard's letter of the 17th inst., referring to my strictures on the "new" telephone published in your issue for June 13th.

If your readers and Mr. Barnard will refer to fig. 1 of Prof. Thompson's specification, No. 9211, 1884, they will find a diagram of the "plug" arrangement in its simplest form. The receiver and battery are here in the main circuit or line wire, and the plug magnet is in a shunt to the receiver and battery. Now, if the plug be replaced by a second receiver and another battery of the same power as the first be inserted in the shunt circuit, so as to balance the first as regards the line, we have Ander's arrangement.

I submit that either, or both, of the receivers in this arrangement, are just as much in the main circuit or line wire as is the single receiver in Prof. Thompson's plan.

Moreover, Prof. Thompson's "beautiful application of abstract science," is not by any means original. Van Rysselberghe has for some time employed a precisely similar plug magnet in his arrangement for the simultaneous transmissions of telephonic and telegraphic messages over the same wire. Professor Thompson seems to have been aware of this, as he expressly mentions in his specification that he makes no claim to the "plug" in any system of simultaneous telegraphy and telephony. Hence, as his arrangement is merely that of Ander's with one battery omitted and the receiver replaced by the "plug," I must confess myself entirely unable to perceive the extreme beauty of the invention. The only possible advantage which the "new" arrangement appears to possess, is that it enables one receiver to be employed, which is impossible on Anders' system. As, however, I notice from their recent circulars that the New Company intend to supply two receivers for each station, on account of the small power of their instruments I presume, this seeming advantage is, after all, of no real value.

Since I wrote my last letter on the subject, I have examined Prof. Thompson's specification, No. 15480, 1884, with a view to discover therein any matter of greater novelty than appeared in his former specification for membrane receivers. Except the application of chrome alum for the purpose of rendering the membrane proof against atmospheric effects, there does not appear to be anything even moderately new, as the jam-pot arrangement of tying the membrane on to a removable truncated ring will be found described in the *English Mechanic* as far back as June 15th, 1877. The chrome alum process is moreover, in itself only novel as regards its application to telephone diaphragms, as it has for long been employed in the preparation of leather, as witness Roscoe and Schorlemmer's "Chemistry," vol. ii., part. ii., page 165.

In their circular the New Telephone Company state that their membrane receiver is a better and more sensitive instrument than those claimed by Bell, and without a competitive trial this statement is difficult to disprove. When, however, the Bell patent lapses, provided no better telephone be brought out in the interval, I, for one, shall be very much surprised if the New Company do not throw aside their membrane, with the complicated process of manufacture, and the ulterior devices necessitated by its use, and employ instead thereof, the in every way simpler iron plate of Bell. The same remark applies, I imagine, to the "plug" arrangement, which at best is merely a makeshift, to render possible the omission of magnets from the receiver.

**"Telephonist."**

*June 23rd*, 1885.

[We have inserted the letter of "Telephonist" as it does not trench upon personal grounds; we think, however, that enough has been said, at all events pending the future operations of the "New" Company, respecting Prof. Thompson's inventions.—EDS. ELEC. REV.]

### Jablochkoff's New Battery.

When the Editor of a scientific publication allows an inventor to explain his invention, and gives him free scope to say about the product of his genius whatever he, the inventor, pleases, we are prepared to listen to abnormal praises of the utility of the invention and to elucidations of the scientific principles (mostly doubtful and dubious) on which this new invention is based; and we can address our criticisms to the same medium from which we received such valuable information. It is different, however, when such praises and scientific elucidations come from the pen of the editor, or may be his staff (his inferior staff), since it puts a certain check upon our language, particularly when we entertain a personal regard for the editor himself.

I find myself in this position, after reading in one of your contemporaries an explanatory and laudatory description of the latest outcome of M. Jablochkoff's inventive genius. To criticise this leading article as it deserves would be an offence to the editor. I should not like to be guilty of this; but I cannot resist the temptation of applying the cudgel to M. Jablochkoff—I beg his pardon—I should say to his interviewer, *à la* Edison. I have not heard the inventor himself speak, therefore he may be innocent and very modest; but we must nevertheless judge the invention according to the front it presents to the public.

Well! this invention makes epoch in history. Here we have a new battery which, if patented, will enable the inventor to apply for an injunction against Volta, Wheatstone, Daniell, Smee, Leclanché, &c., &c., and claim damages for infringement of his patent. But let us listen to the (we'll call him) "interviewer" who calls the invention, "*Jablochkoff's Auto Accumulator*, a very novel and promising form of electric battery."

"The two electrodes are hydrogen and oxygen!" Our mind recalls Grove's gas battery, and we are prepared to hear that M. Jablochkoff has so improved it as to make it industrially and practically useful. But we are informed that the hydrogen "is produced according to the well-known reaction, by the oxidation of a metal, such as iron and zinc, &c." How innocently clever. How Don Quixotic appear all the struggling electricians who have battled with the hydrogen, endeavouring to depolarise the negative electrode by all sorts and condition of materials and compositions, and how grand and glorious steps forth the discoverer of this new battery by showing, to his own satisfaction, that the difficulty is overcome by simply making the hydrogen the positive electrode. But can M. Jablochkoff use hydrogen in any form. Oh no! he *must* obtain it by what he naïvely calls the usual reaction. And what is this reaction? Why, if you, M. Jablochkoff, do not know what it is, then let me tell you that it is a simple voltaic couple. Zinc, calcium-chloride, carbon. This produces the hydrogen, and this, too, produces the electromotive force as shown in the article in question. Iron, 1·1; zinc, 1·6; and sodium amalgam, 2·2 v. Our ingenious inventor then polarises the carbon of this couple and opposes it with carbon charged with atmospheric oxygen—"the action continues until the supply of one or the other of them is practically exhausted." Quite so; like any ordinary battery, and rest is necessary, when the battery will regain its former electromotive force. "And so the process goes on, action following rest and rest following action as long as the *supply of metal* is not exhausted and there remains the small quantity of moisture required for its oxidation." How grandly simple: this battery with electrodes of hydrogen and oxygen depends for its activity on the oxidation of metal, on the presence of an exciting fluid; and "it is curious, however (to M. Jablochkoff or his interviewer), to note that the electromotive force of the battery varies with the metal used, some materials giving much better results than others." So much for the positive electrode.

"The liquid medium of the cell may consist of almost any fluid capable of conducting electricity." This is not true; the first and primary quality of the liquid is that it oxidises the metal, and I question very much whether M. Jablochkoff will get any current if he use iron as the metal (I will do him the honour not to call it electrode), and a solution of potassium hydrate (a very good conductor), as the liquid.

Oh, dear no; it is not the metal, it is the hydrogen that forms the positive electrode.

We now have to speak of the negative electrode—the oxygen, which "is taken from the atmosphere, and occluded in the pores of pieces of open-grained carbon. *This latter circumstance is sufficient of itself to impress the battery with the stamp of originality.* . . . The oxygen-absorbing electrode, the salient feature of the whole battery, and the one around which the principal interest gathers," &c.

I am sorry for the many inventors who have preceded M. Jablochkoff, and who will be called upon for royalties. Leclanché alone, who allows his batteries to be only half filled, that the upper part of the carbon may occlude atmospheric "oxygen"—or, as he terms it, breathe air—will have to pay a pretty sum to M. Jablochkoff for his novel invention; and very likely Mr. Fletcher, of Warrington, who has prepared porous carbon blocks years ago by mixing finely-divided carbon "with other material which will be destroyed in the baking process," &c., will have to render an account to our great inventor. Further, the cunning Yankee, who years ago rotated a carbon disc on a horizontal axis, half in the exciting fluid and half in the atmosphere, to enable it to absorb oxygen, must have known that M. Jablochkoff was going to invent a process which is the "*salient feature*" of this latest discovery, and gives it the *impress of originality.* I will rather not say anything about my own experiments for the last two or three years, for fear M. Jablochkoff might, eagle-like, swoop down upon me. As for the ignorance of the — — — interviewer, we will treat that with contempt.

"It is somewhat difficult at this stage to speak definitely of the future of this battery." The writer made a mistake, it is not difficult, but it would not be wise.

"But the invention has more ambitious views than this (jingling bells), and looks more particularly to the production of motive power as a field for this battery." How beautifully this sounds. "To whatever use it is applied, however, it needs that there shall be a double set of apparatus, one to be resting and recuperating while the other is at work. . . . From time to time, of course, *the battery must be cleaned*; *the zinc salt must be washed out, and the cloths re-wetted*," &c. . . . How commonplace this ending.

We must not laugh right out, but will politely smile at this comet, which "*has a wide future before it*," unless it should prove like a meteor soon to explode through "the occlusion of atmospheric

**"Oh!!"**

London, *June 23rd*, 1885.

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Coats, Capes, Leggings, Hats, Helmets, Knee Wrappers, Diving Dresses, Sheeting for Hospitals, Water and Air Proof Beds, Pillows, Cushions, Bottles, Baths, Life Belts, Gas Bags.

## EBONITE.

*Not affected by Vinegar or Hydrochloric or Acetic Acid.*

Pumps.
Photographic Articles.
Speaking Tubes, Mouthpieces.
Battery Cells.
Sheet and Rod.
Surgical Appliances.

## GUTTA-PERCHA.

Tubing, Belting, Buckets, Bosses for Flax Spinning, &c.

**Works: SILVERTOWN, ESSEX, LONDON, E.; PERSAN-BEAUMONT, FRANCE.**
**London Office—106, CANNON STREET, E.C.**
**Warehouse—100, CANNON STREET, E.C.**

BRANCHES:

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|---|---|---|---|
| LIVERPOOL ... ... ... ... | 53, Castle Street. | BELFAST ... ... ... | 38, High Street. |
| GLASGOW ... ... ... ... | 20, Dixon Street. | DUBLIN ... ... ... | 15, St. Andrew Street. |
| BRADFORD, YORKSHIRE ... ... | 35, Kirkgate. | BRISTOL ... ... ... | 2, Clare Street. |
| SHEFFIELD ... ... ... ... | 10, Castle Street. | NEWPORT, MON. ... ... | 32, Dock Street. |
| PORTSMOUTH ... ... ... | 49, High Street. | CARDIFF ... | Pierhead Chambers, Bute Docks. |

NEWCASTLE-ON-TYNE ... 21, Grainger Street, West.